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New Combination Planing Machine.

We present on this page an engraving of a new combination, or compound metal, planing machine, designed by John Richards, Superintendent of the San Francisco Tool Company, which, together with E. A. Walker, of Philadelphia, and Geo. Richards & Co., of Manchester, England, are engaged in its manufacture. This tool is not to be confounded with the small shaping machines so extensively used at the present day. On the contrary, the design and construction proceeds from the argument that much power is expended in moving heavy masses of metal on large platens; that the stopping and starting of such masses interferes with the proper functions of a planing machine, viz., the removing of a limited quantity of metal, and that the friction incident to operating a planing machine, in which such masses are reciprocated, not only unnecessarily wears out the parts of the machine, but eventually brings about untruthfulness in the work accomplished. Proceeding from these premises, the present machine is intended for use on heavy work, and will be made in sizes as required.

In this machine the work to be operated upon is fastened to the table (two or more of which are fitted to each machine), and the tool is reciprocated by means of a double-thread screw working in a long gun metal nut, which is made in three separate parts, so arranged as to take up lost motion to compensate for wear. The screw gives a strong motion to the tool, and one that is free from all jar, rendering but little preparation necessary for setting the heaviest machines. The motion is also entirely uniform at all parts of the stroke, no change of speed being required to change from the longest to the shortest range, the cutting force not being changed in any way by varying the stroke; but the whole power of the screw being, under all circumstances, applicable directly to the moving of the tool carriage.

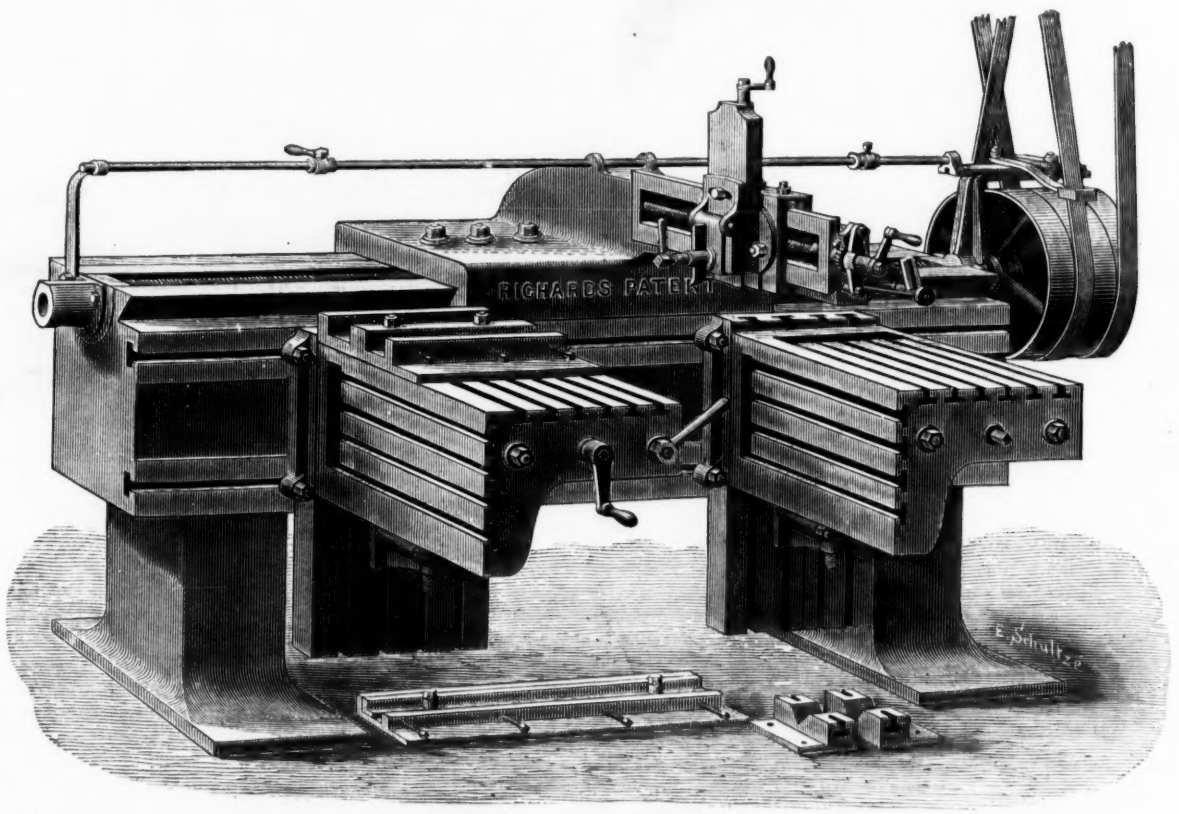
The shifting device is clearly shown in the engraving, and is so arranged as to firmly lock the arms for the stroke in either direction, thus preventing the possibility of the fouling of the belts, and bringing about a very positive motion of the cutting tool at either long or short strokes.

The feed motion is operated by a friction device, and arranged to work out of contact at each stroke, to avoid dragging and the expenditure of power uselessly.

In these machines, the tool acting at a constant height, that is, being uninfluenced in this respect by the size of the piece being planed, the rigidity of the cutting motion is correspondingly uniform.

The tables having true surfaces in three planes, two of which being available for, and adapted in their construction to, the purpose of holding work to be planed facilitates the setting of work, and does away with many special appliances usually found necessary or convenient for this purpose. The use of two or more tables, if desirable, is a convenience in mounting a number of pieces at one time, which can afterwards be planed separately, or pieces can be arranged on one table while the machine is planing those on another.

One of these planing machines is in operation at the works of Walker Brothers, 75 Laurel St., Philadelphia, where, we are informed, visitors may have full opportunities for examination.



NEW COMBINATION PLANING MACHINE.

Extracts from Chordal's Letters.

PERSONAL HISTORY OF A YOUNG MACHINIST.

Mr. Editor.

* * * * A young machinist named John stepped from a train in a large city. He went to a hotel, cleaned the travel dust off, had a good breakfast, and started out upon what he considered the most important expedition of his life. He proposed to see the inside of some extensive machine shops.

* * * * This man John was a quick-witted fellow, son of a country banker, the graduate of a two-cent machine shop. This shop and his home were located far from navigable water and rail. He had worked 5 years at his trade; and had stuffed himself with things from the books, and with ambitions natural to an active mechanical mind. Up to the time that we speak of he had never seen but five machinists. He never saw but one planer, three or four lathes, one drill press, and he had never seen a twist drill. Until he was well started on his long trip he had never seen a locomotive. He had not yet seen a steamboat nor a broad river by daylight, or any form of steam engine, except simple horizontal ones, and the locomotive lately revealed to him.

This young fellow was bursting with inexperience. He had good sense and was as sharp as tacks. He had been palpitating for years with the thought of some day seeing things. Now the day had come; here was a large city full of everything pertaining to industry, and all those things on the most extensive scale. A circle of a day's journey would encompass every ambitious view. A mighty river rolled past the city and could show every type of inland steam craft. Only 50 miles to the ocean, with its massive vessels of sail and steam. Only 100 miles to an immense locomotive-building establishment. There was a large machine-tool-building shop in the city. There was immense water-works machinery, and a rolling mill, and nail works, and fabric mills, and shoe factories—such things, world without end!

This young man proposed to go and work at his trade, if such an ignoramus as he could get work, but he proposed to see something first. He knew not where to begin. He began to doubt his pleasures, as they seemed within reach. He had seen a locomotive, and had been disappointed, because it did not astonish him; it was exactly what he had expected, and nothing more. What would the other things be?

* * * * He visits the water works, and sees one of the most gigantic beam engines in the world. He is not a bit surprised at the size of the engine, but his breath is taken away at the size of the machine work. The books which had familiarized him with monstrous engines had never, for some reason, led him to think of the massive jobs of which such engines are composed. Here were connecting rods which would weigh as much as any lathe he had ever seen. Here was a cylinder near ten-foot bore, with cylinder heads, &c., to match. Up there was a walking beam, and John could not bring himself to believe that all the cast iron which he had ever seen in his life, if put together, would make this beam. Here was a shaft eighteen inches in diameter, and John never dreamed that bar iron was made over four inches. What an immense thing a rolling mill must be! And what immense lathes and planers they must have to do such work!

Then he tried to imagine the lathe that had turned these thirty-foot fly-wheels. In his mind, he sees the lathe bed on legs, with a pile of chips under it; with its head-stock, and tail-stock, and carriage, and tool post, and cone, and back gears, and change gears, and brass plate on the head-stock to tell what gears to use, and a belt shifter over the lathe, and a board on the lathe with tools on it. And then he thinks of the three feet from the floor to the top of the lathe bed, and of the fifteen feet from the top of the lathe bed to the centers—eighteen feet in all—and then he thinks of the little lathe's man only six feet long. How in the world does he work it? Does he use a ladder to look at the tool?

John examines the engine critically, but sees no workmanship to puzzle him; he sees nothing which he has not done himself on a very small scale. He understands the engine perfectly, for he knows the books by heart.

* * * * John visits a big marine shop—the very shop, in fact, that built the big engine he saw at the water works. The first thing he notices is that this high-toned shop is a very much worse shop than the one he was brought up in, and that the only apparent difference is that this one is about five thousand times as big. He recognizes the floor, with its multitudinous heaps of scrap, finished work and litter.

He recognizes the dirty vise benches, the dirty walls, the rickety trestles, the odd blocks, and the greasy, blue workmen. He finds a big planer, and it is a huge one, twelve feet between housings. "But what makes this big planer look so small?" He ponders and scrutinizes, and finally discovers that it is the shortness of the planer which s its dignity. He thinks of the little tw planer at home, and expected to see here same proportions on a grander scale. I seems to him this big planer is no longer than the little one. The big planer, in fact, planes thirty feet long—as long as six of his little planers; but this thirty feet, when compared with the twelve feet between the

housings, seems to be nothing at all. The thing seems to be the longest the short way. He sees that it is all right, but is fearfully disappointed. For years he has been hoping to see a big planer, but he never hoped to see it look like that. He finally comes to the big lathe at work on a fly-wheel like the ones he saw at the water works. "Great guns! is this a lathe?"

A hole in the ground, stone walls, a few odd reckless pieces of casting, and a belt! "How have the mighty fallen!" The man doesn't need a ladder, unless it is to get down in a pit. He sees many kinds of machines, but nothing to surprise him, nothing to please. He sees no twist drills. Between the two shops he would rather have the little one at home which strikes him as being more complete for its work. He looks among the men but sees few faces to make him proud of his trade.

* * * * He goes to another shop and walks in. He hears the foreman talking German and it makes him sick and he walks right out. He goes to another shop and here he finds a boring mill which he studies on for some time. Then he sees a man using a twist drill, and his spirits drop at the complete fulfillment of his hope. He inspects the river craft and thinks the machinery more slouchy than saw mill work. He goes out to the locomotive town but fails to discover anything new. He goes to the ocean and sees the heaviest marine work. What most surprises and pleases him is the consummate skill with which the traps have been gotten into the cramped spaces.

* * * * As in years gone by, our young man, John, again trembles before the door of a machine shop. He is going to ask for employment. He has never done so before and doesn't know how. If he was an old stager he would hunt up the foreman and say: "What's the chance for a job to-day?" But he is not an old stager and never heard that expression in his life.

He goes to the office and asks for the owner of the shop. The president of the company is pointed out to him, and he quickly introduces himself to him by name. He gives the president his history; tells him of the little shop out home; of his experience; of his vast ignorance; and concludes by asking him if he can go to work in the shop on any sort of terms which will enable him to learn something. The president picks his teeth and says in a decent sort of a way, "I think we need some men out in the shop, but we want good men and I don't see what use you can be to us just now, as we can get plenty of learners. You would be the same to us as an apprentice, exactly; but still I will turn you over to the foreman and you can see what can be done."

* * * The foreman gave him less than the president; the shop was full of boys and he wanted men. John went and looked around the shop some and examined the operation of things closely. A new idea struck him based on what he had seen of the shop. He went to the foreman and wanted to hire out as a first-class man. He took the old man's breath away, and the matter finally ended in his being set to work. He was to receive the best of pay if he did the best of work.

* * * * At the end of the week he found his wages set at $2.25 per day. This disgusted him.

* * * * Monday he devoted to business and learned a great deal more of the machine business than he thought there was in it. He called at the office of the President of the company and was well received, and asked to state his business. He opened as follows: "I would like to ask why you don't pay better wages?"

"Young man," said the President, "if you think we set these wages you are mistaken. The machinist fixes his own wages at such a figure that other machinists will not out-bid him. Those wages we have to pay. When a man asks us what we are paying we simply give the figure which our men are charging us. If you were in search of work, and I should tell you that we were paying a certain man $4 per day, you would agree to take that man's place at $3 per day, if $3 seemed high enough to you; is that true or not?"

"Of course it is," said John; "but what will keep the next applicant from under-bidding me; and so on, and so on, till the wages were 10 cents a day?"

"The result of such a course," said the President, "would be, that the lower the wages got the less men would care for the places, and as a consequence, few new men would enter the uninviting trade. Men want the places when the wages are desirable and as a consequence the under-bidding always ceases when undesirable figures are reached. If I should allow men to set their own prices they would always set them a few cents below what other men are getting, so as to get a place. Every man in search of a place is auctioning wages downward. If employers would listen to these bids the trade would soon invite no smart learners into it, and soon we could get no good men at all.

"The policy of employers is to protect the trade against destructive cutting by the workmen. It makes no difference to me how high the wages in my shop are so long as the other shops have to pay the same. That new engine now being built I contracted to deliver for $2,000, and there were over 20 shops bidding on the job. If I had been paying my men $5 per day, some other shop paying only $2 would have got the job and so with every job on which we would bid, until finally, of course, I would have to shut up the shop, and my men would have to seek work in the $2 shops, and in order to get places they would bid slightly under $2. In this way you will see that high wages in one shop will finally reduce the wages all over. If all the shops had been paying $5 this could not happen, because all the bids on the engine would be based on the same cost of machine work. It is not high wages which does the harm in this way, but it is a difference in wages which plays the deuce. Every shop makes the most money during the time they can keep the men at work at the highest wages; this has never failed to be true since the trade was started. You had better cut that out and paste it in your hat."

"Then tell me," said John, "why in the world can't some arrangement be made by which machinists all over the country can get high wages and keep getting them without any bother at all? This would pay the machinists better, and you say the shops would make more money."

"Well," said the president, "I wish that could be; but it cannot. You will see that low wages would chase learners out of the trade and bidders would become scarce, and in a like manner, high wages would bring learners into the trade, and the surplus number of bidders would auction wages down and spoil the whole thing. Another thing is this: That engine you worked on we now sell for $800 and we have a good trade in them. I have sold over 500 of those engines at that price, and as you see we keep about 30 men working on them all the time. Lots of men can afford to buy these engines and so there is plenty to do on them. Ten years ago we never dreamed of selling one of these engines for less than $1,200, and at that figure I never succeeded in selling more than a dozen of them altogether. Few people can afford to buy such expensive engines, and our 30 men would soon have had to go fishing. Instead of going fishing and getting no wages they work for less wages and cut the price of the engines way down, and now, behold, every Tom, Dick and Harry wants one of those engines, and I have no doubt but that these 30 men will be building these engines ten years from now. Let me double their wages and thus double the price of the engine and very soon nobody could afford to buy these engines and we would all have to quit business. I give you this merely as an example, but it will hold good for everything made in machine shops. What would the farmers do if the machinists who build their reapers would charge $5 a day for building them?"

"It is easy to tell," said John, "they would have to cut their grain by hand."

"Well," said the president, "do you know how many hands are now employed on reapers?"

"I should judge," said John, "from what I have read of the reaper business that there must be five or six thousand men at it." (This was many years ago).

"Now," said the president, "do you know of any shorter way for those five thousand men to kill their business of reaper building than simply to raise their price?"

"I don't see any other way," said John, "by which they can kill it at all."

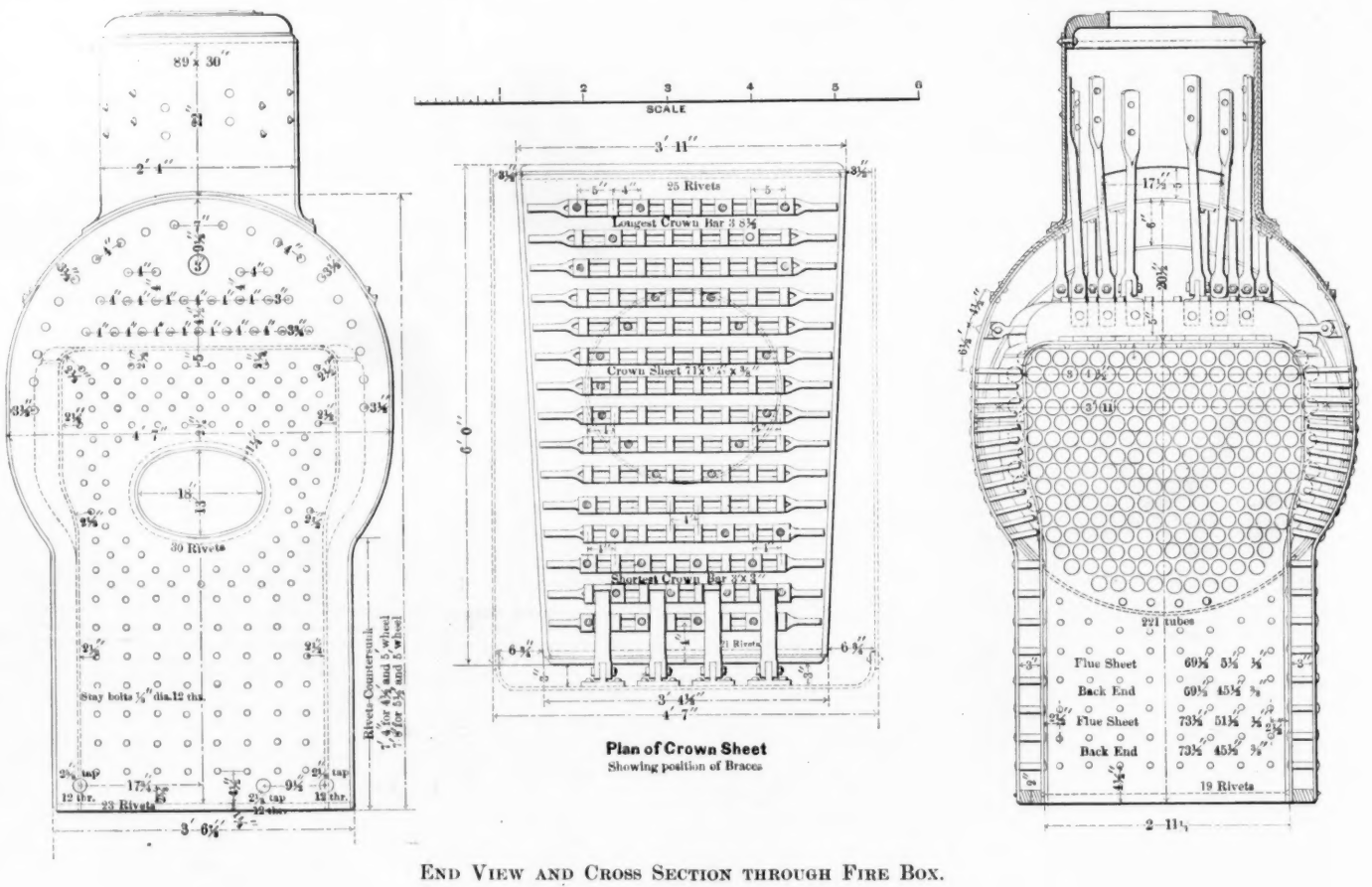
* * * * "Now," said the president, "I have given you the views of a man who has worked 30 years in the shop and I ask you these questions: First, what will keep wages up?"

"Why," said John, "lots of men to buy machine work and very few workmen to underbid on doing it."

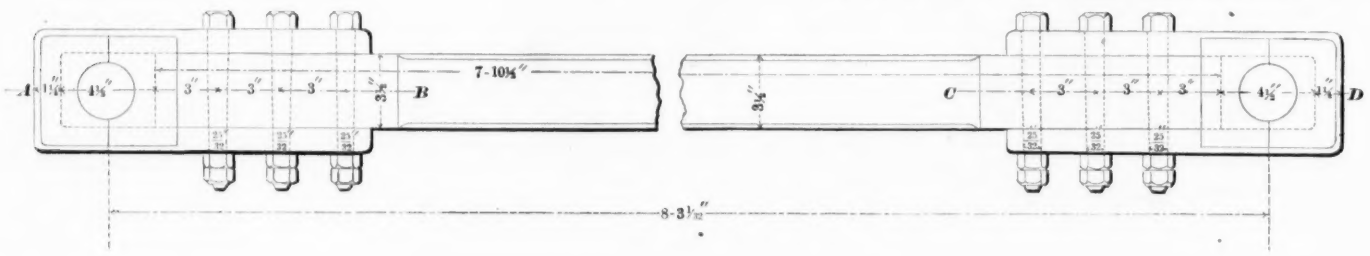
"Second question," said the president, "what will keep wages down?"

"Why," said John, "very little to do and lots of men wanting to do it.

"Next question," said the president, "at what point do wages stop going down?"



END VIEW AND CROSS SECTION THROUGH FIRE BOX.



PARALLEL ROD.

"When they are down so low that they are not worth the having if any lower," said John.

"Last question," said the president, "where is the desirable point to have wages stick?"

John studied awhile and finally answered, "at the highest point at which purchasers will buy all of the work that all of the men will do."

* * * * It was fifteen years ago that I met John as I happened to be working in this same shop. I lost sight of him soon after, but I now have his full history up to date. It is full of interest and his name is well known. You will see that the president has given him plenty to think about for fifteen years; and of the important results, as they occured year by year, I will say a word or two at times in future letters, and thus guard against the interminable length of a continuous history of even a common machinist.

* * * * *

Very respectfully,

CHORDAL.

New Locomotive Boiler for High Pressures.

Some years ago, A. B. Underhill, General Superintendent of Motive Power of the Boston and Albany Railroad, was impressed with the idea of building locomotives for carrying higher pressures of steam, and thus securing the benefits of higher rates of expansion.

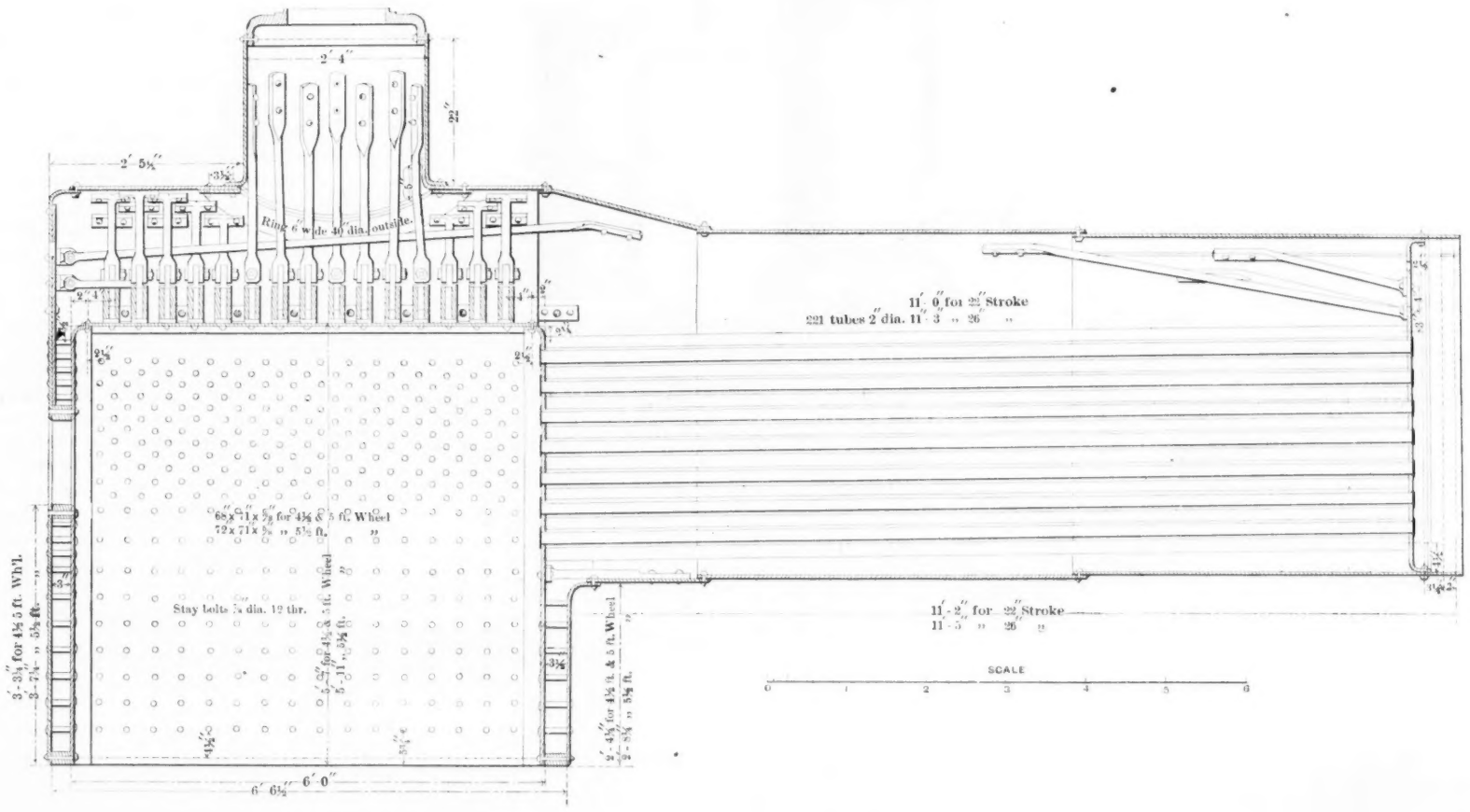
About a year ago Mr. Underhill carried out his ideas practically, by having built at the Boston shops of the road a locomotive (No. 129) for carrying a working pressure of 160 pounds, instead of 130 pounds, the pressure allowed upon other locomotives belonging to the road. With the exception of the boiler, this locomotive is of the usual style run upon the B. and A. road. This boiler is much larger, having more tubes, as well as other peculiarities, which will be readily understood from the engravings on pages 2 and 3, and the following dimensions and data, which were kindly furnished us by Mr. Underhill:

DETAILS OF LOCOMOTIVE No. 129.

Gauge of road	4′ 8½″
Boiler working pressure, pounds per square inch	160
Material—Nashua steel.	
Ultimate strength in pounds per square inch of section	62,760
Elastic limit	45,422
Extension in a specimen 8″ long, per cent	29
Contraction of area at fracture, per cent	53
Style of boiler—Wagon top.	
Diameter of shell, smallest course outside	52″
Thickness of shell	7/16″
Thickness of front and back flue sheets	½″
Thickness of crown, back and side sheets	7/16″
Material of fire box—Nashua steel.	
Fire door elliptical, 13″x18″.	
Depth of fire box, front and back	70⅝″
Length inside	71½″
Width inside	35½″
Grate area, in square feet	18
Distance between crown sheet and outside sheet of wagon top	20½″
Width of crown sheet, front	47″
Width of crown sheet, back	40½″
Water space, front, bottom	3½″
Water space, back and sides	3″
Water space, top, front	3½″
Water space, top, back	6½″
Crown sheet stayed by crown bars and vertical and horizontal braces.	
Diameter of dome outside	28″
Height of dome	22″
Thickness of dome sheet outside	7/16″
Diameter of stays	1¼″
Distance between centers of stays	6′
Clear distance between tube sheets	10′ 10¼″
All stay bolt holes and all rivet holes in fire box are drilled.	
Diameter of stay bolts	¼″
Longitudinal seams, double riveted.	
Circumferential seams, single riveted.	
Diameter of rivets	3/4″
Tubes made of homogeneous metal, locomotive brand.	
Thickness of homogeneous metal locomotive brand	⅛″
Diameter outside of homogeneous metal, locomotive brand	2″
Water space between tube of homogeneous metal, locomotive brand	⅝″
Number of tubes	221
Heating surface of tubes outside in square feet	1,272
Heating surface of fire box in square feet	128
Total heating surface in square feet	1,400
Ratio of grate area to heating surface	1 to 78
Ratio of flue area through tubes to grate area	1 to 3.7
Diameter of stack	14¾″
Ratio of sectional area of stack to grate area	1 to 15
Length of smoke arch	37¼″

WHEELS, CYLINDERS, ETC.

Material of driving wheels—Cast Iron.	
Diameter of driving wheels, inclined or conical tires	5′ 8¾″
Thickness of tires	3″
No flange on forward drivers.	
Distance between centers of drivers	8′ 3″
Distance from center of forward drivers to center of cylinders	11′ 0 1/16″
Distance between centers of truck wheels	5′ 11¼″
Total wheel base	22′ 4 5/16″
Diameter of truck wheels	30″
Diameter of tender wheels	33″
Diameter of cylinders	18″
Stroke of cylinders	22″
Steam ports, length	15″
Steam ports, width	1″
Exhaust ports, length	15″
Exhaust ports, width	2⅜″
Bridge ports, thickness	1″
Valve (Richardson's Balanced) travel	4¾″
Valve lap outside	15/16″
Valve lap inside	None
Lead at full gear	1/32″
Lead at mid gear	3/16″
Eccentrics—throw	4½″
Exhaust nozzles, (Farmer's Double), diameter	3¼″
Dry pipe diameter	5″
Dry pipes in smoke arch	4″
Pistons—Cast Iron.	
Piston Rods—Krupp's Steel.	
Diameter	2¾″
Crossheads—Cast Iron.	
Crossheads, length	14⅞″
Crossheads, length guide surface	13⅝″
Crossheads, width	2 15/16″
Crossheads, diameter of pin	3″
Crossheads, length of pin	3⅜″
Length of main connecting rod between centers	7′ 4″
Material—wrought iron.	
Diameter of main crank pin bearing	4½″
Length " " "	3¾″
Diameter of parallel rod pin	3″
Length " " "	3″
Length of parallel rod	8′ 3″
Material of crank pins and parallel rods	Krupp's steel
Material of axles	wrought iron.
Length of driving axle bearing	7 1/16″
Diameter " "	7½″
Type of frame	Bar.
Material of axle boxes—Cast iron with brass and well babbitted.	
Bearing of truck axles	5″ × 8″
Total weight of locomotive in pounds	80,000
Weight on drivers in pounds	52,330
Weight on truck "	27,670
Tender capacity for coal, 5 tons, but will carry 6 when necessary.	
Tender capacity for water, in gallons	3,000
Weight of usual train, empty B. & A. cars, in pounds	298,000
Maximum grade between Boston and Springfield, to the mile	60′
Minimum radius of curvature of track, in feet	573
Coal (bituminous) burned per mile run during winter months, in pounds	44
Distance from Boston to Springfield, in miles	98.63


2′ 4″
22″
2′ 5½″
3½″
Ring 6″ wide 40″ dia. outside.
2′ 4″
4″
2½″
2½″
11′ 0″ for 22″ Stroke
221 tubes 2″ dia. 11′ 3″ " 26″ "
68″ x 71 x 5/16″ for 4½ & 5 ft. Wheel
72″ x 71 x 5/16″ " 5½ ft. " "
Stay bolts ¾ dia. 12 thr.
3′ - 3½″ for 4½ 5 ft. Wh'l.
3′ - 7¼″ " 5½ ft. " "
5′ - 3″ for 4½ & 5 ft. Wheel
5′ - 11″ " 5½ ft. " "
2′ - 4½″ for 4½ ft. & 5 ft. Wheel
2′ - 8¾″ " 5½ ft. " "
11′ - 2″ for 22″ Stroke
11′ - 5″ " 26″ "
SCALE
0 1 2 3 4 5 6
6′ 6½″
6′ 0″

cess, and another of the same class with some essential improvements is nearly completed. Some engineers will perhaps wonder how so great a number of 2″ tubes could be put into a boiler of the size shown in the engravings, but this has been easily accomplished by widening the top of the fire box at the front end and narrowing it at the back end. By this construction the circulation about the fire box is made better and the desired space allowed for tubes. The top three or four rows of stay bolts have holes drilled in them 3/16″ in diameter extending from the outside ¾″ deep, which is a little more than the thickness of the shell of the boiler. This has been done to indicate, by causing a leak, when a stay bolt breaks, as it is well known that the upper row usually breaks first, just inside the shell.

The March report of this locomotive shows a run of 45.57 miles to one ton of coal, or 3 cents per mile less than other locomotives hauling the same train. The parallel or coupling rods used upon this engine and shown in the engravings, are constructed with no keys, using tapered bolts instead of keys.

The advantages of this method are that the rods cannot be tampered with by driving keys but must be adjusted in the shop. They are also capable of being adjusted to the exact lengths required.

This locomotive runs the fast express from Boston to Springfield in two hours and forty two minutes. It must be borne in mind that fast running upon the B. & A. road is attended with very different conditions than upon a level road like the New York Central and other similar roads, from the fact that from Boston to Charlton, the highest point on the Eastern division, steam has to be used constantly, and the engine pulls heavily all the way. Charlton is 57¼ miles from Boston and 903 feet above the sea level. The intermediate grades are all heavy, but No 129 recently ran from Boston to Worcester, a distance of 44 miles, in 58 minutes, the usual running time being 70 minutes. The train consisted of one baggage car, three heavy drawing-room cars and three ordinary passenger coaches. A full stop was made at Columbus Avenue and another at South Framingham, besides an extra stop at Wellesley and slowing up in going over the new Park bridge. This locomotive since it first came out has been regarded as an entire suc-

Drills for Small Holes.

At the machine shop of L. S. Bunnel, Troy N. Y., we recently noticed the drilling of small holes (less than $\frac{1}{32}$" diameter), the drills used being made from stock as cut up and straightened ready for making needles. The job in hand requiring the drilling of these holes by the thousands, the needle blanks were procured from the manufacturer, the size being exactly that required, nothing being necessary to complete the drill except to grind to proper shape, heat in a gas jet and temper. One of these drills will drill a large number of holes, the drilling being accomplished with great rapidity. Mr. Bunnel is authority for saying that a needle as complete and tempered for use, ground to the proper shape, makes an excellent drill for an odd job.

New Feed-Water Heater and Condenser.

There are two important offices that are, or that may be, performed by a feed-water heater, either of which will result in the saving of a very material percentage of the fuel required for generating steam. One of these is the heating of the feed water to nearly the temperature of the steam or waste heat used for heating it, and the other the removing of a considerable portion of the impurities in the water, which otherwise enter the boiler to the detriment of its steaming efficiency.

We present with this a section and elevation of a feed-water heater and condenser, the invention of J. H. Turner, of Fort Wayne, Ind., and which is manufactured for the Fort Wayne Heater and Purifier Co. by the Bass Foundry and Machine Co. of that city. This heater is designed to utilize exhaust steam, or the waste heat from the jackets of a steam engine, cylinder, heating pipes, or from other available sources. As here illustrated, it is especially arranged for heating with exhaust steam.

It will be seen that it consists, essentially, of two cylindrical shells, within the larger one of which is situated a pipe or shell, through which the feed water passes on its way to the boiler. The exhaust steam enters the larger shell, as shown, and, circulating around the internal shell or heater, passes to the smaller shell or condenser.

The feed water enters at the top of the condenser, forming a spray by means of the rose, and is thus brought into contact with the entering exhaust steam, a portion of which it condenses, the resulting water, together with the condensing water, falling to the bottom of the condenser. Usually a portion only of the exhaust steam will be condensed, and, to provide for the free escape of the remainder, the pipe connecting the two shells is provided with a branch, through which it is allowed to pass.

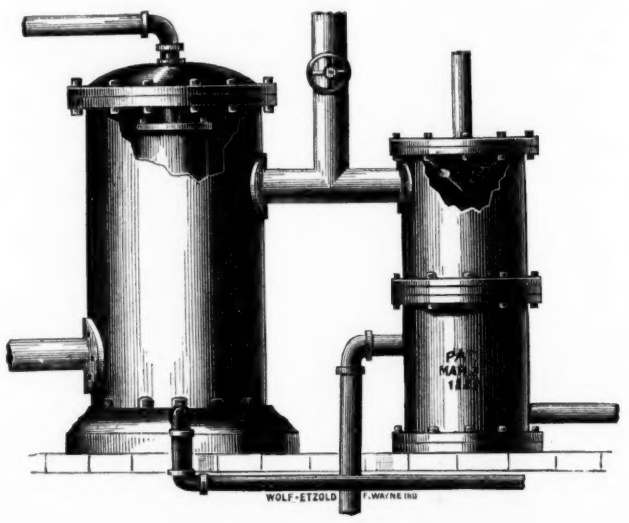
Towards the bottom of the condenser, but at such a distance from it as to leave in it a considerable body of water (in amount proportioned to the capacity of the heater), a surface overflow pipe is connected. About midway between the bottom of the condenser and this overflow pipe the suction for the pump is taken, the object of this arrangement being to overcome some of the objections to the class of heaters in which the feed water is brought in direct contact with the exhaust steam, or with other steam used for heating the water. In this manner the water in the condenser is heated only to about 140°, and the gases and vapors which accumulate, being drawn off through the surface overflow, are neither forced into the boiler, where they have an injurious effect, nor drawn into the pump, where they operate to prevent its working. The pump, taking its supply from the center of the still water at the bottom of the heater, is always supplied with solid water, free, on the one hand, from the gases and lighter impurities which are discharged at the surface overflow, and, on the other hand, from the heavier matter, which, settling in the bottom of the condenser, is from time to time blown off through the bottom drain pipe, shown in the engraving.

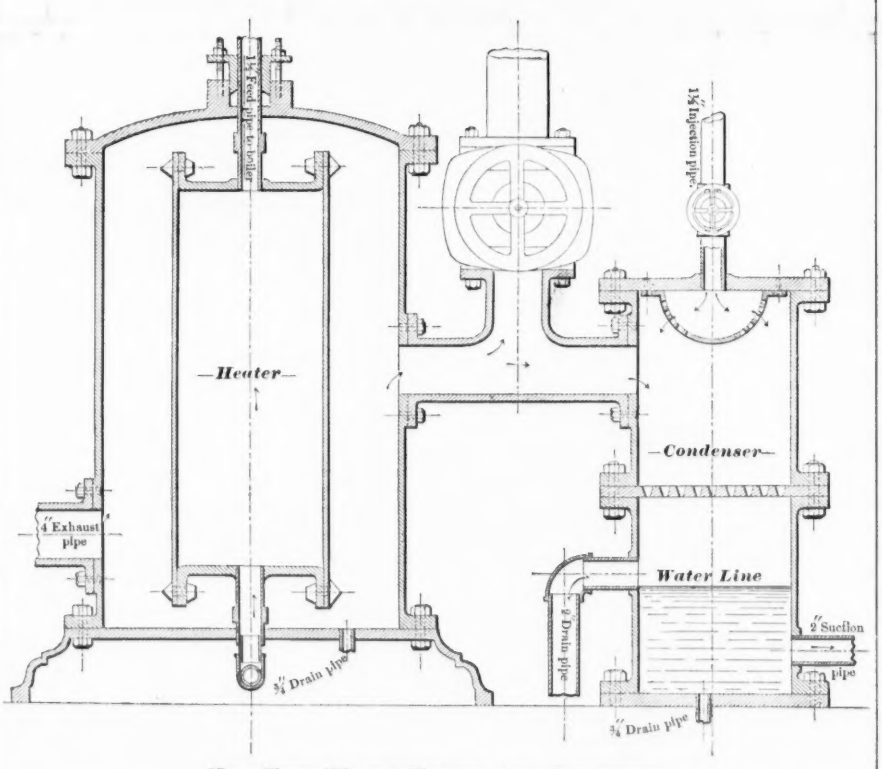
From the pump the water (already heated to about 140°) passes through the heater proper, as indicated, where it is heated to substantially the temperature of the steam in contact with the shell.

In the bottom of the larger shell is a drain pipe, which keeps it free from the water of condensation; this water (which is nearly at the boiling point), instead of running to waste, being taken directly to the suction of the pump, where it increases the average temperature of the feed.

This heater is quite simple in the arrangement of its parts, and the connection of the inside with the larger shell is such that it is not affected by the difference in expansion of the separate parts. The heater proper, which is of comparatively small diameter, is the only part that is subjected to boiler pressure.

When used to heat the feed water by means of the drip from the steam jackets of an engine cylinder, the arrangement is necessarily slightly different from that here shown, and, under ordinary circumstances, it is said to be good economy to heat the feed from 225° to 235°.





NEW FEED-WATER HEATER AND CONDENSER.

The York Globe Valve.

We present with this an engraving of a new globe valve, designed with the view of furnishing a valve at the usual price of such products, and at the same time one in which the more serious objections to the ordinary globe valve are removed. These valves are manufactured by Frey and Broomell, of the Diamond Brass Works, York, Pa., and are made as described in sizes from one inch up.

Referring to the cut it will be seen that the screw by which the valve is operated is outside the stuffing box, or where it can be seen at all times as well as kept properly lubricated. Unlike the ordinary globe valve this stem does not revolve in its operation, the hand wheel being provided with a long inserted composition nut shouldered in the

NEW GLOBE VALVE.

yoke, which latter is made in one piece with the cap. The turning of the hand wheel revolves the nut on the stem, the latter being prevented from turning by a screwed spline fitted to a longitudinal slot in the stem. This effectually prevents the circular cutting motion of the valve on its seat in opening and closing, without the use of a loose disc, and also saves the otherwise rapid wear in stuffing box. The solid stem and foot permits the safe use of the valve either side up, as there is no danger of the foot becoming detached. It can at any time be seen at a glance whether the valve is open or closed, the arrangement being such that the top of the stem will be just flush with the outside of the hand wheel when closed.

Another important feature in the construction of this valve is the providing of a seat on the reverse or back side, by which means, when the valve is screwed hard open a joint is made against the bottom of the stuffing box, so that the stem can be packed with steam on equally as well as with steam off, or with the valve closed; a matter of considerable importance in instances where two or more boilers are connected together, as well as in locations where it would be inconvenient to shut the valve off in the event of the blowing out of the packing.

The provisions for re-grinding the valve, should it become necessary after extended use, are very simple, it being only required to turn back the spline screw with a screwdriver and insert a key (for which provision is made) between the nut and the stem, when by turning the hand wheel the valve is revolved on its seat, the yoke and cap forming a correct guide for the operation.

Electrical Apparatus and Processes for the Mining and Metallurgical Engineer.

BY N. S. KEITH.

A PAPER READ BEFORE THE AMERICAN INSTITUTE OF MINING ENGINEERS.

Concluded from last issue.

The process which has within a year or two been reintroduced by Siemens for melting steel by electricity can be applied to melting other metals and materials. The apparatus for this operation is comparatively simple. Take a black lead crucible of proper size and put it in another suitably larger, and in the space between the walls of the two pack some good non-conducting material like asbestos. Introduce through a hole in the bottom of this combination a carbon rod, like one used in the electric arc light, and lute around it well with a paste of clay and graphite, so that it forms a conductor to the interior of the inner crucible. Next provide a cover, with a hole in the center of a size to freely admit another carbon rod. Now place above the crucible the mechanism of an electric lamp so that the carbon carried by its movable rod can enter the crucible through the hole in the cover. Place in the crucible an amount of steel, or other metal, put on the cover, pass through the hole in it the carbon rod, and connect it with the movable carbon carrier of the lamp; connect the body of lamp with the positive pole of the current generator, and then connect the carbon which passes through the bottom of the crucible with the negative pole. Immediately the upper carbon will be automatically withdrawn slightly from contact with the metal in the crucible and form a voltaic arc at that place. Fusion goes on rapidly, so that some pounds of steel can be fused in twenty minutes. The lamp mechanism serves to keep the carbon rod at its proper separation from the metal. Siemens says that there is no other equally economical mode of fusing small amounts of steel, because there is none which so concentrates the heat upon the material which it is desired to fuse. In fact the fusion takes place before the outer crucible is raised any considerable degree in temperature.

The latest development in electricity is in the so-called "storage" of it. By the term "storage of electricity," I do not desire to be understood literally, any more than I would be so understood in speaking of the store of heat in coal. It is merely a convenient term, which avoids giving a chapter in physics. The first storage of electricity, other than in its so-called static condition, was effected by Planté in his well-known secondary battery. In this case, as in all subsequent arrangements for storage, energy is absorbed in the decomposition of water by electricity, which is again given up as a current of electricity when the proper circuit is furnished; or, better said, when the proper association of materials is made. The value of this arrangement of Planté, and the scope of application of its modifications has not been recognized until recently.

There is nothing to be gained by expending zinc and acid for the production of electricity to effect chemical decomposition, for sake of the subsequent reverse action as electric current, as the battery can be used directly whenever such current is desired. But the recent mechanical means of genera-

ting electricity have so cheapened its production that it is now sometimes desirable to store up the electricity produced, as it were, in some portable form, so that it may be utilized in a place which is not available for its direct production and use.

The line of development which has received the greatest attention is the one of which Planté's secondary battery is the type. Faure's arrangement is the most prominent. The capacity of both depends upon the porosity of the surfaces of two lead plates; one in connection with the positive, and the other with the negative pole of a source of electricity. Planté's cell acquired its limited capacity by the result of repeated oxidations and reductions, effected electrolytically, of the surfaces of the lead while in a bath of acidulated water. Faure increased this capacity by applying a coating of oxide of lead directly to the lead plates, so that the increase on a given surface, in comparison with Planté's, is in the proportion of 2,000 to 75.

The operation of charging and discharging these cells is as follows: A source of electricity, having an electromotive force somewhat in excess of two volts, is connected, as before stated, with the two lead plates in a bath of water acidulated by sulphuric acid, and the current is allowed to flow in them for a time, limited by the current and capacity. The result is that the coating on one plate is peroxidized, and the other has its coating of oxide reduced to metallic lead. If the source of electricity be then disconnected, and the wires which are attached to the lead plates be kept separate, the charge will be only very slowly dissipated. But if the wires be connected, either directly or through any conducting substance, an electric current will flow in the reverse direction to that which was passed through the arrangement from the source of electricity, until the original condition of oxide on both plates is resumed. The action of the current through the plates is first to decompose the water of the solution in which the plates are immersed; the oxygen goes to the positive plate and is absorbed in peroxidation, while the hydrogen goes to the negative plate and acts there as a reducing agent, making metallic lead from the oxide. The reverse action takes place when the wires are connected. So it will be seen that the original electric current determined a chemical affinity, which, when circumstances allow, reasserts itself with the development of a current of electricity. On a future occasion I expect to be able to describe a storage battery of my own invention, the particulars of which I am not at present prepared to give.

Sir William Thomson found one million foot-pounds of electrical energy stored in a box weighing, with its contents, 180 pounds, made by Faure, at Paris, which he set free by use in Scotland.

The decomposition of only one pound of water by electricity absorbs about 5,300,000 foot-pounds of energy, which can be drawn at will from the storage battery through an electric motor. This equals 2⅔ horse power for an hour. The waste power in the process of storing is not yet well determined, but the economic results promise to be favorable, and if expectations be realized, the applications of "bottled electricity" will be many.

DISCUSSSION.

PROF. C. O. THOMPSON: Can you give me any information with regard to a possible pollution of the atmosphere by the electric light through the formation of compounds of oxygen with nitrogen?

MR. KEITH: I cannot say that there are any specific data on this point. Ozone is probably formed, and that may possibly act upon nitrogen of the atmosphere to form nitric acid. Some investigators have said that nitric acid can be detected in the neighborhood of the voltaic arc, but not in deleterious quantity. Ozone acts to oxidize organic matter, and to that extent may be a purifier of the atmosphere.

MR. G. W. MAYNARD: I am glad to bear testimony to the utility of the electric light in mills. I have seen it in use in several mills having from twenty-six to sixty stamps, with great success. The apparatus used were generally those made by the Brush Company, and are of the arc type. The light has a very penetrating quality, especially useful in the dust of dry stamp mills. Under its use the amount of work done by employes is very materially increased.

Electricity is used for the refining of black copper in South Wales, by the Messrs. Elkington. I believe they use a chloride solution instead of a sulphate, so that insoluble chloride of silver is formed at the anodes. A very large number of tanks are used, and the electric generators are those made by Wilde, of Manchester, England. This process is also in use at Mansfield, Hamburg, and other places in Germany.

MR. H. M. HOWE: Will Mr. Keith tell us whether one pound of his apparatus, including apparatus and contents, will contain as much energy as one pound of coal; and also, roughly, what will be the cost of 1000 foot-pounds as stored in this manner, that we may see how the cost of energy so stored compares with its cost when stored in coal?

MR. KEITH: The comparative aggregates of energy are due to the combinations of two elementary substances in each case. In one to the union of oxygen and carbon for heating water in the production of steam for an engine; and in the other case to the union of oxygen and hydrogen to form water with an incidental current of electricity. The amount of energy due to these unions is well known. Twelve parts of carbon combine with thirty-two of oxygen to from forty-four carbonic acid, with a freeing of energy equal to about 11,000 foot pounds. Two parts of hydrogen combine with sixteen of oxygen to form eighteen of water while 6,800 foot-pounds of energy are freed. Our best steam apparatus utilizes scarcely 10 per cent. of the energy due to the combustion; but it is a very poor electric motor which will not utilize more than 50 per cent. of electric energy supplied to it. Some recent machines are said to utilize from 85 to 90 per cent. Thus it will be seen that, pound for pound, the electric energy is the greater. The energy due to the union of oxygen and hydrogen to form a pound of water exceeds five million foot-pounds; and this can be stored for use electrically in apparatus weighing not two hundred pounds.

MR. HOWE: So there is more available power in one pound of your machine than in one pound of coal?

MR. KEITH: I cannot now say that, when we take into consideration the weight of apparatus. But in the matter of materials which go to develop the energy—yes; and in the proportion of about fourteen to nine. And in the matter of available energy, this is probably large enough to more than counterbalance the weight of apparatus.

PROF. SILLIMAN: I have had some experience in the deposition of copper by the dynamo-electric machine, both practically and theoretically. The process may, in my judgment, be made a commercial success In the particular instance to which I allude it was not commercially successful for the want of a large enough dynamo. We had not at that time one of sufficient "quantity." One was begun by Mr. Weston, at Newark, of suitable magnitude, but failed of completion owing to destruction of his works by fire. It is merely a question of cheapness of power and the use of a suitable dynamo; always with the understanding that the attempt must not be based upon doing work beyond the capacity of the dynamo.

Steel wires are coated with copper at the works of Wallace & Sons, at Ansonia, Conn., for use in telegraphy. Copper enough is deposited on them by electricity so that small, strong conductors are produced, equal in conductivity to the much larger and heavier iron wire heretofore used.

MR. KEITH: I doubt the relative economy of the use of electricity in the separation of gold from silver. The process used in the government assay office and mints gives by-products, which pay very much of the expense of separation by means of acids.

MR. HOWE: While black copper is successfully refined electrolytically at Birmingham and Mansfield, copper refiners in this country in vain endeavor to learn how to do it. I have clients who would pay any reasonable price to the man who could carry out the electrolysis of argentiferous black copper rapidly and cheaply. This is one of the great needs of the copper industry in this country.

A very interesting process for the extraction of aluminum from its oxidized compounds has lately been described to me by its inventor. The aluminous compound is placed in a carbon crucible, which is connected as the cathode of an electric current of great intensity. A voltaic arc is then thrown across from another electrode against this carbon crucible, the current thus first melting and then decomposing the aluminous compound, and metallic aluminum being deposited on the sides of the crucible.

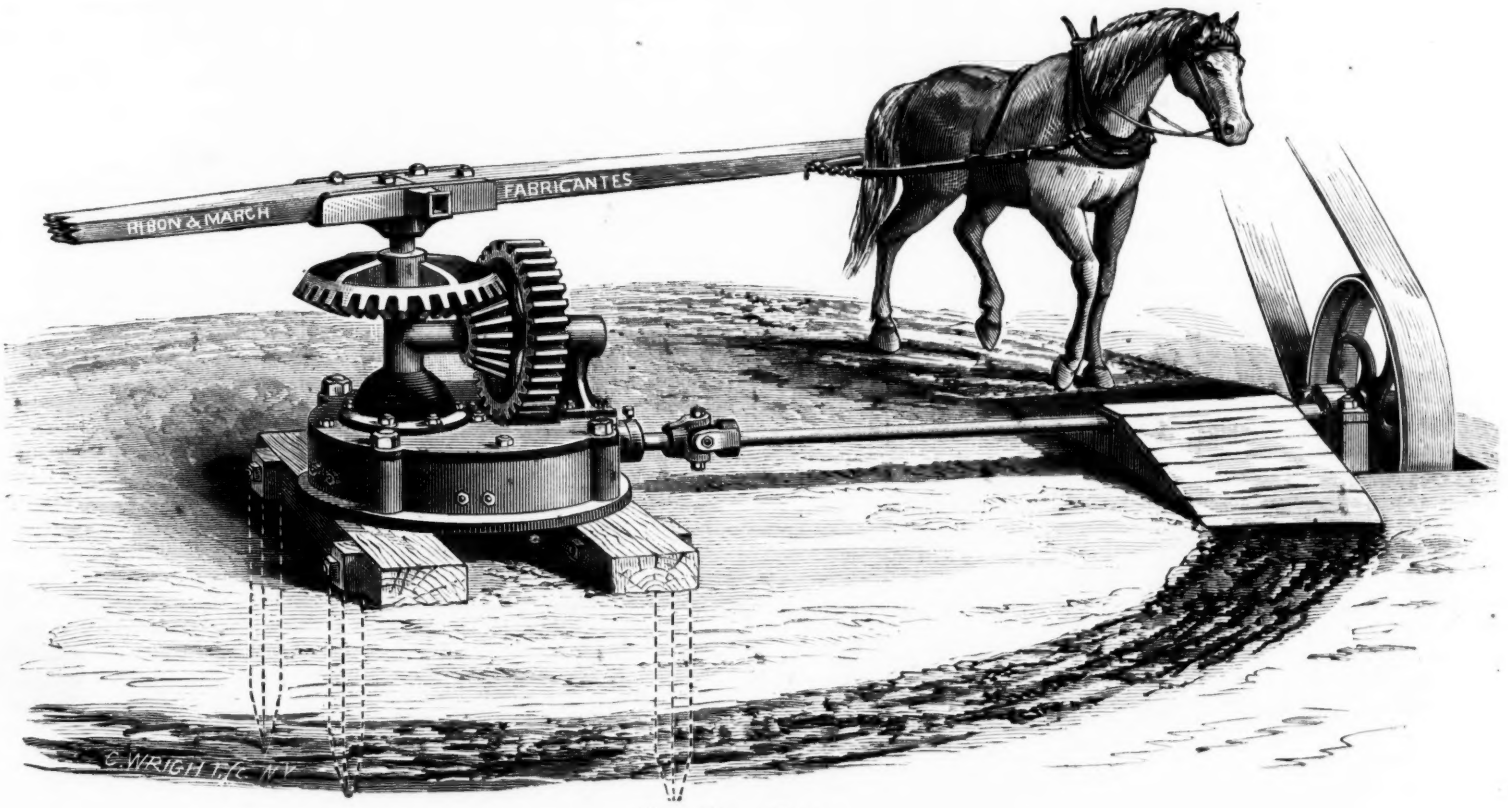
MR. KEITH: I have heard such a process vaguely hinted at, but must say that I do not understand how aluminum can be produced except by some variation of the process.

New Horse Power.

The accompanying engraving represents a new design in horse power recently brought out by Ribon & March, Jersey City, N. J.

The noticeable features of this machine are its great compactness, and the fact that no single piece in the machine weighs more than 150 pounds. This latter feature is made a part of the design, amongst other reasons, so that when taken apart any piece of it may be transported on the back of an animal across mountains, and to places which it is impossible to reach with any kind of wheeled vehicle. It is made entirely of iron with a view to have no parts that are liable to decay, which, in the case of wood, is very rapid in some southern countries.

These horse powers are made in sizes for one, two or four horses.



NEW HORSE POWER.

We were recently told of a gentleman in New York who wrote to England for the address of the manufacturer of a machine which he was desirous of purchasing, and received a cablegram to the effect that it was manufactured and sold at Newark, N. J.

Coal Dust as Fuel.

In reference to this, George Gifford, United States Commercial Agent at Nantes, France, reports to the department of State, in substance, that the manufacture of the bricks is quite simple, about 10 per cent. of pitch being used in the process. He says:

The coal dust is mingled with pitch derived from coal tar, and the mixture poured into cups attached to a belt, each cup containing just enough material for a brick of the desired size. The belt in its movement passes this material through a chamber where it is exposed to hot steam which fuses the two substances into a homogeneous mass. This is poured by the descent of the belt into moulds, where it is subjected to an enormous pressure by a hydraulic press, or by machinery set in motion by a steam engine.

The coal dust used is largely imported from Wales, and the cost of manufacture is given as follows:

Coal per ton in Wales	$1.00 to $1.25
Freight on same	1.60 to 1.60
Duties on same	0.26 to 0.26
Handling, sifting, &c	0.56 to 0.56
Tenth of a ton of pitch	1.00 to 1.20
Total cost per ton	$4.42 to $4.87

The pitch used is made from coal tar produced in the manufacture of illuminating gas, and cannot be had in sufficient quantity in Europe, hence the manufacturers are looking for a supply from the United States, where it is believed it may be had in quantity sufficient at least for all the immediate purposes for which it is required.

LETTERS FROM PRACTICAL MEN.

Some Points About Chimneys.

Editor American Machinist:

In a recent number of your valuable paper I saw and read the communication of "Chordal" respecting stacks. Allow me to say, as a draughtsman and a lover of mechanics, that I think Mr. Chordal's theory is absurd.

He starts out with the statement that a chimney is nothing but an expensive hole for smoke to go through.

The principal function of a chimney or stack is to cause draught. They certainly do carry off smoke, but let me ask if there were a fuel that needed draught but gave out no smoke would our friend make a good use of that fuel without a stack?

If Chordal can prove the following assertion to be correct, I will never make a draught for another stack.

"A brick chimney one hundred and seventy-five feet high will swing from two to six feet." He places the minimum at two feet. I do not believe that there is a stack in the United States that swings fifteen inches, and I speak from practical experience as well as upon the best authority. Taking the quantity of brick into consideration, a square stack is the strongest and cheapest one that can be built. I was draughtsman for one of the largest and I believe the tallest stack in the country. It stands one hundred and ninety (190) feet from the ground and is built on a running sand, or rather quicksand.

The foundation is a block of concrete, thirty (30) feet square and five (5) feet thick, and is composed of granite spauls and about two hundred barrels of the best Portland cement. The stack is thirteen (13) feet at the base and, not counting the head, is eight feet nine and one-half inches (8 ft. 9½ in.) at top; the flue is six feet at bottom and six feet eight inches at top.

About three hundred and fifty thousand (350,000) dark stretches and hard brick were used in its construction. In reply to Mr. Chordal's assertion that a square stack is built with common labor, I would say that the best labor was employed on our stack, in proof of which I need only remark that the stack was not plumbed from the start to the finish except, of course, with the regular four feet batter plumbs, and when it was finished and plumbed, it was but seven-eighths (⅞) of an inch out of plumb.

Einvechter & Sons, of this city, were the builders, and Chas. Holt, of England, the engineer and architect.

HERMAN DOCK.
9041 N. Broad st.,
Phila., Pa.

Heat Economy.

Editor American Machinist:

In issue of April 29th, Mr. Charles A. Hague, in one of his very interesting articles, calls attention to heat economy in his concluding paragraph, as follows: "There is a grand mystery yet to be solved by steam engineers, viz., why is it that the water in the boiler having absorbed such enormous values of latent heat holds tenaciously to it, even down to the lowest pressure to which expansion can be carried in condensing engines? Steam entering a cylinder at a pressure of 135 pounds per inch above the atmosphere contains 51,191 heat units per pound weight, while steam at one pound pressure above absolute vacuum is charged with 1,112 units, a difference of 149 pounds in absolute pressure and only 79 in heat units.

"But the instant that complete condensation takes place the resulting water holds but a trifle more than 69 units per pound. If the theory is correct, the thing to do is to transform the heat into work, instead of allowing it to run away in the water."

The question is well designed to promote investigation of this important subject, and may lead to a beneficial exchange of ideas.

Hoping to be benefited by the opinions of others, I offer my own views (subject to amendment and correction), which have been formed from reading and practical observation. If by "resulting water" Mr. Hague means to include the necessary volume of injection water used in condensation, at 69 units per pound, I see no particular error in his premises.

The intimate association of units of heat and high pressure looks as though he knew how to state the case in a strong light.

Of these 1,191 units of heat, 990 of them were absorbed in obtaining steam at atmospheric pressure, leaving only 201 units of heat to be charged to the additional 135 lbs. pressure. But this is no fault of the question; the engineer must look out for that himself.

Mr. Hague says: "If the theory is correct, the thing to do is to transform the heat into work, instead of allowing it to run away in the water."

I think that the engineer who undertakes to do this will lose his time. When the heat goes into the condenser, it has performed its work, and, by the immutable laws of nature, is as free to go on its way as the water which has passed over the wheel, and reached the level of the river bed below.

The well-known law of equivalents says: "All forms of force or energy are convertible, and an apparent disappearance of any one is necessarily compensated by the appearance anew of an equivalent amount of one or more other forms."

A similar law of mechanics says: "Action and reaction are equal."

These are the principles of the best kind of book-keeping. Let us see how they will apply:

	Dr.
Given, units of heat	1,191 units
DISBURSEMENTS.	Cr.
Forming steam at atmospheric pressure	990 units
Furnishing repulsive force between particles of steam to increase pressure to 135 lbs.	201 units
	1,191 units

It is an even balance, and we cannot get any more of these units than all of them, and we cannot get the 135 lbs pressure with any less units per pound.

The resulting work from this 135 lbs. pressure depends upon the density of the element into which it may be discharged. Heat is the motor, the force, the energy. Steam is only the medium for retaining and conveying the heat, and to get the full benefit of this heat, it must be discharged freely, fully, and forever, just as much so as the water must be discharged from the water wheel. If we do not need all of this force at once, we may allow it to expand in the cylinder, which in effect is to discharge gradually, but all of the expansion will come from the 201 units, or units of pressure; the 990 units of latent heat will keep right along to the condenser. The team is holding on to the 990 units for its life; that is why it holds on so tenaciously even down to the lowest pressure to which expansion can be carried; for steam cannot live at a less temperature than that of its latent heat.

By means of expansion we have the benefit of high steam, which is cheap steam, and also have a reserved force for governing the speed of the engine. High steam is cheap because water will not change into steam until it has absorbed its quota of latent heat, or heat which becomes latent. After it is once changed into steam the pressure rises rapidly with very little additional fuel. Here is a compensation for its great absorption of heat in the form of water, if we are only wise enough to profit by it.

As to why water requires so much heat to change it into steam, I would just as soon think of asking why it did not require more, or why it would change into steam at all.

It is the nature of it, and that is all we know about it.

We do know that to change the form of any substance involves force.

It may consume force or it may produce force. The engineer can put in his time to good advantage in seeing to it, that the heat from the fuel goes into the water and steam, and not into brick walls, the chimney, or surrounding atmosphere, and that it is not diverted from its purpose in its passage to the condenser.

Defiance O. ANTHON.

Advertising for a Foreman.

Editor American Machinist:

Mr. Olin Scott has done better by his 182 correspondents, in his letter of May 20th, than the majority of men do who advertise for a man to take charge of work. It is quite the usual thing with such advertisers to consult only their own convenience in answering such correspondents at all. Mr. Scott's requirement of politeness in a foreman, I hope, will suggest to some such advertisers that it is polite to answer a respectful letter, however humble the writer may be.

Mr. Scott's advertisement was very alluring, and as he had the discretion to place it in a paper that is largely circulated, and promptly read, advertisements and all, I think he may well be proud of his success as far as he has gone. If he will advertise as temptingly for a head bookkeeper, in as popular a mercantile paper, and he does not receive as many applications and from as many incompetents, I will pledge my week's wages to pay for the advertisement. And if the "powers that be" should advertise for a man to be postmaster at Bennington, Vt., the rush and roar of the fight for that office would pale into insignificance General Stark's Battle of Bennington.

To me, these things seem only the result of the universal desire to improve our condition, and I believe that this desire is implanted in man for wise and beneficent purposes; and if a foreman, superintendent or owner cannot, by his example, aid in developing in some of the young men about him this desire into a real intention to reach beyond the level of the journeyman's station, he ought to sit down for a little reflection.

If employers would encourage local talent more, there would be less disposition in young men to seek promotion abroad, and there would be fewer advertisements for foremen and superintendents. The chances are largely against a man in going into a strange shop – a stranger to every one – and assuming at once the direction of work in the presence of men looking on with a jealous eye, and who know more about that particular work than he does, and are trained to the ways of the owner and of the shop. It takes a good disciplinarian to succeed as foreman in such a case.

But perhaps the too good-natured owner's ways show a decided lack of discipline and his ways have become the ways of all the men about him, until in the shop confusion reigns triumphant. In such a case, advertising for a foreman in the hope of finding a disciplinarian may be the best way.

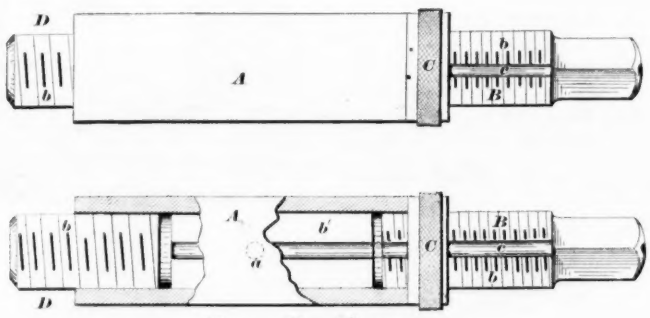
It is a mistake to admit for a moment that a foremanship is a "no labor" job. A foreman should be an active and deep thinker. Thinking is hard work. *There are more men too lazy to think than there are too lazy to work with their hands.* A good foreman will do more hard thinking and take more steps in a day than any two workmen that he has in the shop, and when night comes, too often the burden of thought hangs upon him.

Mr. Scott's enumeration of the acquirements of a foreman is good and reasonable, but to promulgate them with a threat in advance, publicly made from the housetops as it were, as in the last paragraph of his letter, grates harshly, and I cannot think that this is his every-day style.

To cringe for his pay, and tremble for the tenure of his office does not have a tendency to develop a high order of ability in a foreman.

Q. K.

Cincinnati, Ohio.



HANDY NUT MANDREL.

Handy Nut Mandrel.

Editor American Machinist:

As you solicit any items which may be of interest to others, I accept your invitation, and enclose a rough sketch of a handy tool for holding nuts while being squared up in a lathe. The holder consists of a thimble *A*, provided with a pin or spline, *a*. *B* is a mandrel made to fit snugly in the thimble, although not too tight to prevent its moving easily in same; *c*, is a recess in which the pin *a* plays and prevents the thimble from turning on mandrels; *b*, *b*, are threads cut on either end. *C* is a nut for determining the distance that the nut (which is to be squared up) can be screwed on mandrel at the end *D*.

In operating the holder the milled nut, *C*, is moved back or forth until the nut, which is screwed on end *D*, and against thimble *A*, will sufficiently overhang the end of mandrel to allow of being squared up. By this arrangement any thickness of nut may be had without injuring the threads on mandrel. The threads on mandrels, as commonly made, are soon cut up and rendered useless.

The tool just described having proved itself time-saving and valuable, is, I think, entitled to a little space by which it can make itself known. As far as I know, it is not patented, and is, therefore, free to all.

CHAS. C. ABBE.

South Windham, Conn.

Disadvantages of Modesty in the Shop.

Editor American Machinist:

In your valuable paper for May 20, a letter from Olin Scott attracted my attention, for it reads like the Ohio farmer's letter to an orphan asylum for a boy that would get up early, work hard all day, not want to go fishing or to see the circus—one having a good education, and of a kind and amiable disposition. The superintendent said he always sent those boys to heaven for angels, and not to the country to learn farming.

Olin Scott seems to be very exacting in prescribing the qualifications of a foreman. Why don't more proprietors of shops look to the educational qualifications of journeymen? It would be for their interest to do so. There are men in all shops who read and improve themselves, and who possess the necessary qualifications for good foremen. Yet most of these men stand back because some others, with more cheek and tongue, succeed in pushing forward.

JOURNEYMAN.

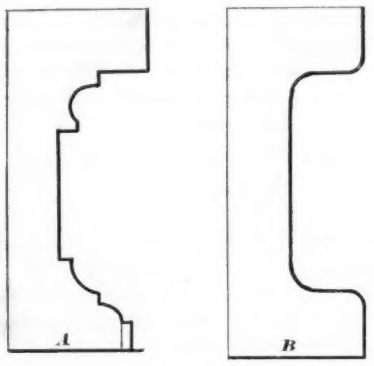
Hamilton, Ohio.

Strength and Finish of Machine Tools.

Editor American Machinist:

Your correspondent, Geo. B. Foote, asks why so many manufacturers of machinery use square shoulders and corners instead of round.

Whitworth was always a great advocate of round corners in every thing; even his V threads are slightly round, both top and bottom. His plan in the construction of machine tools is to make everything as severely plain and bald-looking as possible, and to spare no expense in the working parts in order to have them durable. Any latheman of experience knows that it is much easier to hide bad work by using sharp corners at the junction of a curve, and poor workmen invariably leave either a lump or a hole when they scrape a plate wheel at the boss or hub.



The first cut *A*, represents a relict of barbarism. The second cut *B*, although plain, is in reality more difficult to finish properly. A really first class turner will scrape the latter so that if the forefinger is rubbed over it no lump or depression will be found. But give it to a man who has never learned to scrape, and he is sure to make a botch of it. The sharp corner ornamental beads and cabinet-maker style has long since been abandoned, in fact, was never in vogue with the makers of massive and expensive first class tools.

If machine tool builders only knew how difficult it is to get time to repair tools, in some shops, they would use harder cast iron and not make the ways as soft as possible. The great thing that is wanted now in machine shops is to have tools heavy, powerful, durable and stiff, so that there will be sufficient resistance to a cut. Some people think otherwise, and say that these modern machine tools are clumsy and unnecessarily heavy, that everything is sacrificed to strength. They prefer light, handy, short-lived machines.

There are different opinions about friction. Some contend that short carriages on small Vs run more easily, but they invariably get slack where most used. Long-lived tools are the thing.

JOHN K. CANNON,

Ft. Wayne, Ind.

Not Whitwell's Apparatus.'

Editor American Machinist:

Our friend Chordal, in the AMERICAN MACHINIST of June 3, does an injustice to Mr. Thomas Whitwell in a reference to the flash of flame and steam by which he was fatally injured. There was time for one to escape, but he waited for some one else, a foreman, or leading workman, to get away first. It was a Bicheroux furnace, with producer attached, and not a piece of apparatus of Mr. Whitwell's own designing.

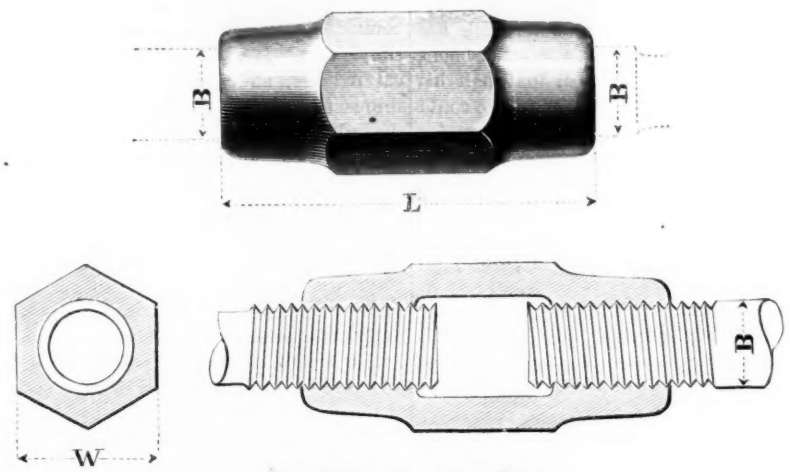
Springfield, Ill. P. BARNES,

Standard Right and Left Nut.

Gradually, but surely, the character of machine and machinery construction has been changed during the past few years, by the bringing of one after another of the minor and common details to the condition of a standard article of manufacture. The old-time practice of making such parts of machines and machinery as were in no way special or peculiar to particular products in a hundred shops, in which the quantity used in any one would not warrant the employment of machinery devised for their correct and uniform production at a nominal cost, has given way to the practice of making all these parts in one shop, in which the required machinery can be profitably used. This results in the proper attention to such details, bringing about not only cheaper construction, so far as labor is concerned, but a corresponding saving of material and the better adaptation of means to the end, which is the great aim of all machine design.

In the accompanying engraving is represented another effort in the direction indicated, in the production of a standard right and left hand nut—an important detail in machinery construction which, it will be admitted, exists in varieties not always either pleasing to the senses or economical as to cost.

In this nut a section of uniform strength and symmetrical appearance is provided by the use of the least practicable weight of metal, to accomplish which, it is necessary that the fibers of the iron shall lie in the direction of the strain, and also that there shall be no welds that are liable to be parted by tensile stress. To these ends, in the forging, the metal which is to form the nut is, by the use of the necessary machinery, first welded horizontally, making a uniform hexagonal section over a core of similar section. Subsequent operations bring the ends to the tapered circular section with rounded corners, as shown, at the same time reducing the holes, to the proper form and diameter to be tapped.



NEW RIGHT AND LEFT NUT.

As will be seen, this leaves the weld in a direction not to be disturbed by tension or compression, and the fibers of the iron directly opposed to the stress, the strength being sufficient to break a steel bolt of the size adapted to be used.

The part of the nut that is left hexagonal is, in diameter, the same as a corresponding U. S. standard nut, adapting it to be adjusted with a standard wrench.

These nuts are manufactured, in a large variety of sizes, by the Edge Moor Iron Company, whose New York office is at 79 Liberty Street.

The Rome Locomotive Works.

We condense from the Rome (N. Y.) *Sentinel*, the following description of the new locomotive works in that city. There are at present about fifty men employed about the works, but active operations will not commence till near the first of July. The capacity of the works will be seventy-five locomotives yearly, with room for doubling the number if required:

The buildings are substantially constructed of brick, and consist of a carpenter shop and foundry, machine, blacksmith and boiler shop and engine house. The blacksmith, boiler and machine shops form three sides of a hollow square, within which is the engine house. The machine shop runs northeast and southwest, and the blacksmith and boiler shops and the engine room join it at right angles. The carpenter shop runs parallel with the machine shop a few feet east of it. All the shops are tin roofed and are well lighted and ventilated.

The blacksmith shop is 175x60 feet. Ranged along either side of the building are nine double fires, making thirty-six in all. In the center will be placed four larger fires for doing heavier work, making a total of forty fires. The side fires will be used for doing light work and the middle ones for doing heavy frame work. In this shop is located a heavy pair of shears which will be used in cutting bar iron, also a 650 pound steam hammer. One of the most curious machines in the works is in this shop. It is a steam bolt machine, by means of which a perfect bolt may be made in the twinkling of an eye. A bar of red-hot iron is introduced in the machine and it is chopped up into perfectly headed bolts in a wonderful and curious manner. Several blacksmiths have been at work for some time making tools, etc.

One passes directly from the blacksmith into the machine shop. This building is 270x80 feet in dimensions and two stories high. A number of the machines were imported from England, not because those of English manufacture are better than those made in this country, but because it was impossible to get the orders filled here in any reasonable length of time. The English machines were made by Fairbairn, Kennedy & Naylor, at Leeds. One of these is a three-headed slotter, which is used for slotting the locomotive frames. It is 36 feet long and weighs 25 tons. Another is a four-headed side rod planer. It plains both the rods at once, on sides and ends. Another is a cylinder borer, which bores the cylinder and squares up the ends at the same time. It is not so pretentious an appearing machine as some others, but it does much work. One of the heaviest pieces of machinery in the collection is the double-headed driving wheel lathe. By means of this lathe two driving wheels are turned at once. The bed is one casting, and is the heaviest at the works, weighing, as it does, more than six tons. Then there is a fourteen-inch slotter for cutting key seats in driving wheels, etc. There is another one coming of American manufacture. There is also an English quartering machine for boring crank pin holes. Then there is a car axle lathe and a planer for planing cylinders. The planer is 60 inches high, 60 inches wide and 10 feet long. Another planer, used for planing frames, is 28 feet long. A horizontal boring and drilling machine is for general use; also an upright milling machine. There is a 36 and a 38-inch upright drill, three 10-foot planers, two spindle drills, an 84-inch horizontal boring and turning machine, which latter is used for boring and turning driving wheels and tires. There is a 50-inch drill and a 26-inch swing lathe. There are seven more large lathes coming. The south end of the machine shop is taken up with five erecting stalls, where the different parts of the locomotive are assembled and put together to make the iron horse. Near the middle of the room is a steam elevator of six tons lift for transferring articles to and from the second story. The second floor will be used as a machine shop for lighter work. All the heavy work will be done on the first floor. On the second floor are lathes, planers, shaping machines, etc. A portion of this floor is partitioned off for a tool and store room. In this room is a water tank of boiler iron, holding some 2,800 gallons. From this tank water is distributed by means of pipes throughout all the buildings.

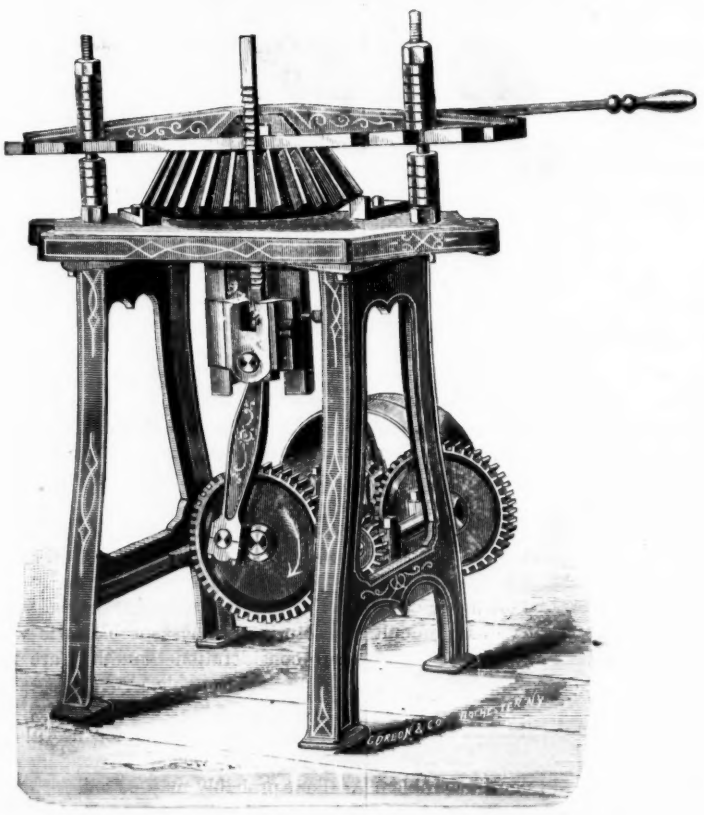
The boiler shop is 175x70 feet, one story high. In it are the forges for heating and forging boiler plates. Here also are two machines called combined punch and shears for cutting the boiler iron, and punching the holes for rivets. An ingenious and labor-saving machine is a chamfering machine and planer for chamfering and planing boiler sheets. There is also a boiler plate roller for rolling the iron into circular form for boilers, and a horizontal flanging punch for punching holes in flanges. One of the most useful machines is a steam riveter, which is daily expected, and which rivets the sheets together while the boiler is swung in mid-air. There is also a suspension drill and a cutting-off machine for cutting boiler tubes, bar iron, &c.; a very handy invention.

The carpenter shop and foundry are located in one building, and are separated from each other by a brick partition. The building is 270x80. Of this 170 feet are taken up by the carpenter shop. An elevator will connect the first and second floors of the carpenter shop.

The foundry which is in the northeast end of the building, with the carpenter shop, is 100x80 feet.

The building which contains the engine and boilers is 40x50 feet. The engine which is to furnish the motive power for running all the machinery is of 100 horse power and was manufactured by F. C. & A. E. Rowland, of New Haven, Ct. It has a 14-foot fly wheel with 24 inch face. The cylinder is 18x42. Steam is furnished by three large boilers. One of these will be used as auxiliary and for heating purposes, if necessary. In the boiler room is a Norwalk steam pump which supplies the boilers and tank with water from a well under the machine shop. The arrangements are such that the city water can be turned into the pipes which supply the buildings, at a moment's notice.

The pattern room is located on the second floor over the carpenter shop. The south corner of this room is partitioned off for the draughtsman's room. It is a very pleasant room, well lighted and ventilated and commanding a fine view of the country around.



NEW KEY SEAT CUTTER AND SLOTTER.

Key Seater and Slotting Machine.

The cut of machine here illustrated is the latest improved key-seat and slot cutting machine, as made by W. P. Davis, North Bloomfield, N. Y. This machine is very powerful, and will cut from ¼ to 1 inch slots very rapidly, saving the use of a slower working and more costly machine. This is of importance, as many manufacturers can hardly spare a planer for such work, when a machine at one-tenth the cost will do the work better and quicker. These machines have been so perfected that any man with ordinary judgment can operate them, and do ten times as much work as can be done by hand, and the saving in files will soon pay for a machine, when much cutting is required. As the cutting is done by saws, the seats are always the same width. This machine has extension table and improved saw clamp and chuck blocks. Has been arranged with great care to give strength, durability and ease of adjustment, at a low price.

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NEW YORK, JUNE 17, 1882.

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The Machine Tool Industry.

Since the feverish excitement in placing orders for machinery has, in a great measure, abated, the business of building shop tools has settled down upon a firmer and more substantial basis. The piling up of orders for six to ten months ahead of the capacity to fill them may cause high gratification for a time, but certain drawbacks are likely to become apparent during the continuation of such a state of affairs, that will cause a decline in the satisfaction with which they had previously been contemplated. A large increase in the cost of labor and materials has often caused a manufacturer, with order-books filled to overflowing, to wish that half his contracts for delivery in the far future could be canceled. With a surplus of orders for delivery, at specified dates, unforeseen difficulties often arise, rendering it impossible to deliver the work when promised, when the failure to do so is sure to be followed by unpleasant consequences. Were a penalty to be insisted upon in every case of inability to execute contracts for machinery, within the limits of the time specified in the agreements, a great many forced and unpleasant settlement of accounts would have taken place within the past two years. Fortunately, however, the temper and good sense of machinery users throughout the country have been proved superior to the temptation to take advantage of delays of this kind to demand damages for them, although suffering in most cases unquestionable losses by prolonging the time of waiting. Builders of machinery have, as a rule, acted in good faith with customers, although having almost constant opportunities to obtain higher prices for their productions than those accepted from buyers whose orders have been standing for months upon the books.

Unforeseen delay in securing one machine has frequently thrown back orders in certain shops, and these, in turn, interfered with the filling of other orders, thereby disturbing the current of mechanical industry to a greater extent than the builders of the original machine ever dreamed of.

These anomalous conditions of business are gradually disappearing, and orders are being placed nearer the date upon which machinery is wanted for use. Both manufacturer and purchaser will be benefited by this equalization of demand and supply. New enterprises requiring machinery to start them will be enabled to get under way without waiting for equipments until their promoters lose all interest in them. Improvements, both in shop processes and productions, will be stimulated by something like competition. When the volume of orders becomes only about equal to the capacity of shops to fill them, we may expect to see fewer parties without special aptitude for the business rushing into the making and selling of shop machinery. Indeed, it would not be surprising to see some of them, already started, seeking other fields of operations. While there is likely to remain abundant room for the production and sale of first-class shop tools, the time may not be far distant when those devoid of any special merit will be difficult to sell, even at low prices.

A Mechanical and Scientific Problem.

A great mechanical and scientific problem of the future is the utilization of waste forces and the employment for useful purposes of the revealed active forces of nature. Science and skill pride themselves, justly enough, upon what has been done in these directions, but when the enormous wastefulness of most ordinary processes are considered, the magnitude of that which *may* be done so far exceeds that which *has* been done as to modify any feelings of exultation.

It is a part of human nature—not entirely because it is comparatively easy—to seek to improve paths that have been already travelled rather than to look for and to carve out new ones, and the world is largely indebted for its material progress to those who work in directions that have been pointed out by others; but to get out of any path, however rough, and to travel in directions that others have not even proposed to travel, is not only something quite different, but something quite essential to higher material progress.

Satisfactory progress undoubtedly calls for those who shall with infinite patience put together and utilize facts already known as such, but it also calls for those who shall dig up new facts, leaving, if necessary, to others the duty of assorting and fitting them to their proper places, or finding new places for them.

That the putting in practice principles, and the utilizing of things already known and common is a somewhat tedious process is a simple fact. It is by no means, in mechanical matters, an easy thing to fit common things to common places, however obvious the adaptation may appear when reasoning back after the accomplishment.

A few years ago the steam engine, for ordinary purposes, required the consumption of double the amount of coal to accomplish the same end that it does to-day, but to bring about what is termed the present perfection, literally thousands of men working substantially in the same direction have accomplished the utilization of about one-tenth of the heat liberated by the combustion of fuel, and this at the apparent approximate end of the road. This is progress, and as such is by no means to be held in low estimation, but the fact that such a waste exists without indication of how it is to be remedied, shows the necessity for pointing out a new direction in which to work; a direction in which perhaps lies the possibility of quite reversing present results. That this is not in the way of being accomplished is not that there is not ready energy enough for the purpose, but probably that there is not at hand the single individual to point out the way. It is not that there has not been thought enough expended on the subject, but that it has not been expended in the right direction, or with the right purpose in view. The great difficulty is that current thought will not turn itself to the discovering of new facts.

The determination of the means of working with a heat engine without this enormous waste awaits discovery, and, when discovered, will undoubtedly be found great only in its simplicity. Without a knowledge of the mechanical equivalent of heat, it might be expected that this loss would forever go on. With the knowledge of exactly what is lost, it is improbable that it will do so.

But quite aside from present processes, which mainly look to the utilization of energy long since stored up, is the fact that heat, which for mechanical purposes is only changed to another form of motion, is already at hand in such quantities as to be neutralized at considerable expense, and usually by the liberation of more heat. Whether the knowledge of how to utilize a larger per cent. of the heat set free by the combustion of fuel shall include the knowledge of how to conserve for useful purposes natural heat may be a question. That the means of accomplishing one or both these ends in a practical degree will eventually be known is an altogether reasonable supposition. That the solution of these problems is worthy of more consideration than they are receiving is quite as reasonable.

So it may be said of electricity, that it is made to manifest itself for useful purposes only by costly, wasteful, roundabout means, while it probably may be had for the asking, if the question is properly framed.

Taken altogether, notwithstanding the progress that has been made, the manner in which we contrive to utilize the forces of nature, for mechanical purposes especially, is in the highest degree unsatisfactory; and the knowledge we now possess on this subject is just sufficient to indicate the probability that the possession of more—perhaps only one or two more simple facts—would entirely revolutionize present wasteful processes. The fact that we artificially generate heat — in the summer, for instance — at trouble and expense, and at the same time are at equal trouble to protect ourselves from heat that is quite too much for other purposes, indicates a direction in which investigation may eventually be successful.

The problem is a grand one, and one upon which but little or no light is being shed; in fact, it does not seem to be attacked with the energy and persistency essential to success.

Proposed Changes in the Newspaper Postage Laws.

The Postmaster General has made a recommendation to Congress, favoring a law to exempt newspapers and magazines from the payment of postage upon their circulation. We believe the law already permits country newspapers to circulate free in their own counties, but this privilege is indefensible on its merits and should not be extended further. Certainly city journals of whatever style or degree, that are fit to live, are published with at least an ulterior view to profit, and should neither ask, nor are they entitled to receive gratuities of this sort, at the expense of the taxpayers of the country. Legitimate journals can afford to pay postage on their circulation, quite as well as merchants can afford to pay express charges on their goods or farmers to pay freights on their produce. The reduction of letter postage to two cents, and of the minimum fees on postal orders to five cents, as proposed, would doubtless be beneficial to every citizen, while an unjust discrimination in favor of none.

While Congress and the Post Office Department are about it, however, they might well pay attention to the more equitable working of the present laws relating to second class mail matter. Nearly everybody in the newspaper business knows that these laws are daily being violated by a considerable number of publishers, who send thousands of copies of their journals every week or month to so-called "subscribers," persons and firms who never ordered the papers, do not want them, and are never asked or expected to pay for them. Journals which are not mere advertising sheets, and which have a legitimate circulation, if they desire to take advantage of the law permitting transmission through the mails at "pound rates," should be and doubtless are, willing to prove to the post-office authorities, that they are entitled to the privileges which they seek under such a law. The opportunity of sending a reasonable proportion of their total circulation through the mails as specimen copies (each copy so marked), with a view to increasing their paid circulation, is one that all newspapers can fairly ask and the government fairly grant with advantage to its revenues. But taxpayers generally are entitled to such revision of the present regulations on this subject, as will make them definite enough to admit of enforcement.

In this connection, there is one earmark which may be pointed out to some advantage. Weekly newspapers especially which claim a large circulation, and habitually go through the mails with written wrappers only, or printed wrappers which neither indicate nor mention the date up to which the subscriptions are paid, can usually be looked upon with some suspicion.

Assistance to Beginners.

Some parties in mechanical occupations occasionally give vent to their wonderment as to why so few American young men enter upon learning trades, and stick to them until they pass the novitiate, and become skilled journeymen. The most peculiar thing about the apparently puzzled understandings of these parties is that they never seem to think that boys need any special encouragement to induce them to enter mechanical pursuits. Sunday-school books abound in shining examples of boys who started by sweeping out stores, banks, or lawyers' offices, and who rose step by step until they became confidential clerks, and finally partners in the concern. The boy who is inclined to choose the shop, rather than the office, as the arena of his efforts, would have to search through a prodigious pile of that class of purified literature before he could find one such glowing example to stimulate him in his chosen course. When a boy is apprenticed to a lawyer or a green grocer, the chances are that

the men in that shop who have learned the trade wont hinder him in his efforts to acquire a knowledge of the business—they probably will be willing to help him, if he is active and anxious to learn—but there are more chances, if he enters a machine shop, that some of the men will delight in placing obstacles in the way of his progress. If he seeks information on some special matter from one of these self-sufficient mechanics, it is more than probable that a trick will be played upon him, or that he will be subjected in some way to ridicule.

We do not mean to say that this is the rule among mechanics, but that there are exceptions enough to worry the ambitious apprentice in almost any shop. Those men whose ideas about mechanical operations are most valued by skillful and experienced workmen have the most sympathy for those desiring to acquire a knowledge of the machinist trade. This fact is made apparent by articles in the AMERICAN MACHINIST from such writers as Prof. John E. Sweet and Chordal, who are never tired of encouraging and assisting young beginners, as well as older workmen, in mechanical pursuits. No class of individuals appreciate such encouragement more than novices in the shop, and we are constantly receiving evidences that the efforts of these writers are productive of much benefit.

Differences between the iron manufacturers and iron workers in Pittsburgh and the West in regard to a scale of wages for the year, beginning June 1st, have led to the shutting down of a great many mills, and idleness of thousands of workmen. This condition of affairs is greatly to be regretted, as millions of dollars that would be paid out in wages, and go into circulation in every channel of general business, will be lost to the country should this lockout continue. The price of iron may advance in consequence of shutting down the mills, but that will not add anything to the wealth of productive enterprise. It would seem that differences about wages involving such extensive interests could best be settled by arbitration, with justice and satisfaction to all parties immediately concerned.

A Large Steam Whistle.

Our Canadian neighbors are entitled to tally one on the score of making a noise in the world; the Eaton, Cole & Burnham Co., of New York, having abetted, by furnishing to an enterprising lumber concern of that section what is, so far as we are aware, the largest steam whistle on any industrial establishment in the world. This whistle, which stands four feet nine inches high, has a bell twenty inches in diameter, and is attached to the boiler by a four-inch connection. It is made entirely of composition (bronze), and is highly finished all over. It will require a liberal battery of boilers to supply the steam for an extended "toot," and the music will undoubtedly sound charming—from a distance. We congratulate the manufacturers on the character of their job, and as heartily commiserate the hapless people who live in the particular section in which this whistle is to be located.

Laziness in Thinking.

In one of our "Letters from Practical Men," occurs this expression: "There are more men too lazy to think than too lazy to work with their hands." The fact that men can work industriously with their hands every day from "early morn till dewy eve," and yet be lazy, perhaps, has impressed itself upon only a small proportion of intelligent observers. A little reflection, however, will discover that there is nothing inconsistent in such an assumption. There are artisans and business men who make progress to a limited extent and stop right there for the remainder of their lives. They are never found idle during the time for work, yet *they don't think* with any original effort. The man who thinks while he works with his hands is head and shoulders above the steady plodder who manifests no desire to make improvements by studying out cause and effect.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, vertaining to our specialty, correctly, and according to common sense methods.

(199) P. G., New York, asks; If in a boiler perfectly tight, a quantity of water be boiled for an indefinite period, and then allowed to condense, will the original amount of water remain? *A.* If you mean pure water we should say yes.

(200) W., Brooklyn, N. Y., writes: Mr. Forrest gives a very good way to get the proper angle of bevel wheels, but presupposes the blanks to be chucked on a face plate. Now will he please tell how he manages when they are turned (as three quarters of them are) on a mandrel?

(201) O. E. W., Concord, N. H., writes: I have been told of an engine with a stroke of 24 feet, but, doubting the statement, I want to ask you if engines are made of such a stroke? *A.* It is possible that there may somewhere be an engine with a stroke of 24 feet but we know of none. Strokes of from 12 to 14 feet are about the limit in ordinary practice.

(202) J., Raleigh, N.C , writes: I am runing a locomotive equipped with a blowback valve, which heats the water in the tender so that the injector will not work. Is there any way to make an injector work water hotter than 120 degrees. *A.* You can probably do nothing to the injector that will help it in this respect.

(203) C. H. H., Batavia, N. Y., writes: We have a steam hammer that does not work well. I think the valve is not set properly. It is set to cut off at about half stroke which I think is not right. Please let me know how to set it? *A.* We cannot tell how the valve should be set without knowing more of the circumstances. We should if possible shift the valve and observe the results until they were satisfactory.

(204) F. H. S., Columbus, Ind., asks: 1. Where is the pressure the greatest in a boiler; at the top or at the bottom? *A.* Theoretically the pressure would be the greatest at the bottom, being greater there than at the top by about one pound for every 28" height of water. It is claimed by some that in experiments made, the pressure has been no greater at the bottom than at the top, which if true would indicate some cause annulling the operation of a natural law. 2. If the pressure is the greater at the bottom why can steam from the top force water through an injector and into the bottom of the boiler? *A.* An injector will force water against a much greater pressure than that of the steam used in it. 3. Will an ordinary steam gauge answer to test the matter with? *A.* You can use two gauges but they must be known to agree accurately, as in an ordinary boiler there would be but little difference in the pressure at the top and bottom. Even then it would be advisable to use cocks so that the gauges could be quickly reversed in position, as a futher check.

(205) J. C., Philadelphia, Pa., asks: 1. What is the meaning of the phrase, terminal pressure? *A.* In a steam engine the terminal pressure is the pressure in the steam end of the cylinder when the exhaust valve opens. Sometimes for convenience of calculation it is taken as meaning the pressure that would have existed in the cylinder at the end of the stroke if the exhaust had not been opened. 2. How is it that a condenser sometimes causes loss of efficiency when the cut off is very early? *A.* The condenser has the effect to cool the cylinder so that a good deal of heat is abstracted from the steam to restore the temperature. When the cut off is very early but little work is done and the quantity of heat abstracted and wasted by the cool cylinder bears so great a proportion to the total heat used as to result in a loss. When a condenser is not used the cylinder is not cooled so much during exhaust, and hence the difference in temperature between the exhaust and admission is not so great, and less heat is required to restore the temperature. The usual remedy for light work in a condensing engine is to carry a lower pressure of steam. 3. What is an ejector condenser? *A.* It is much the same as an injector condenser, that is, the direct force of steam is used to take the place of an air pump.

(206) J. P., Overbrook, Pa., writes; In examining an old fire engine built about 25 years ago I observed a mercury steam gauge. I do not see them on engines built recently. I should like to ask: 1. Upon what principle does it work? *A.* There were formerly two kinds of mercury gauges in use; one a vacuum gauge in which the upper end of a glass tube was connected with the condenser, and the other end immersed in a vessel of mercury. The pressure of the atmosphere on the mercury in the vessel caused it to rise in the tube just in proportion as the pressure in the other end was removed, and the height of the column of mercury indicated the degree in which the condenser was relieved from pressure. Sometimes a bent tube was used with one end open and the difference in height of the mercury in the two tubes indicated the degree of vacuum. In the mercury steam gauge the steam pressure took the place of the atmosphere, and the pressure was measured by the height that the steam forced the mercury up the column. 2. Why are not such gauges used at present? *A.* They are used to some extent for vacuum gauges, but the high pressure of steam at present carried would require a tube of such a height that its use would be inconvenient. There are gauges in use to some extent in which mercury is used to indicate the pressure much the same as the pointer on a spring gauge. Such gauges are not properly speaking mercury gauges.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

We receive numerous inquiries relating specially to matters of private interest. While desirous to oblige our friends, we would suggest, that an advertisement of two or three lines under this heading will usually develop the desired information easily and quickly.

Portable Forges, $10. Holt M'fg Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

Presses and Dies. Ayar Mach. Works, Salem, N. J

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Do you manufacture Hardware or House furnishing goods you wish sold in New York? If so, address Manufacturer's Agent, care of AM. MACHINIST.

Machinists' Bench Tools; largest stock in the United States. Send for Machinist Catalogue, 212 pages. Tallman & McFadden, 607 Market st., Philadelphia.

"Steam Economy," 124 pp., cloth, $1.00 (illustrated), points out remedies for defects in engines. Best indicator practice. A. Wilkinson, 123 n. 4th St. Phila.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users and engineers. [Mention this paper.]

"Slide Valve Gears," by Hugo Bilgram, published by E. Claxton & Co., Phila., describes the easiest method known for correctly proportioning slide valves, link-motions and cut off gears; price, $1.00.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

If you desire to keep pace with the daily progress and development of Telephone, Telegraph and Electrical matters, have a copy of the NEW YORK REVIEW OF THE TELEGRAPH AND TELEPHONE sent to your address. Only $2.00 per annum. George Worthington, Editor and Proprietor, No. 23 Park Row, New York. P. O. Box 3329.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 Humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

Important to Millwrights, Machinists and Pattern Makers—I have compiled a complete and absolutely correct table of The Diameters of Toothed Wheels on Pitch Line, by which any mechanic can instantly find what he requires or wants, without calculating. This table should be in the chest of every mechanic and millowner, and in the office of every manufacturer, as it saves hours of time, and dollars of money. No algebra to learn, no arithmetic to study. I have also added the computation table of what is known as the "Manchester Principle." Price, $2 per copy. Address, Wm. T. Ross, care Bremaker & Moore Paper Co., Louisville, Ky.

MANUFACTURES.

John Roach will erect a four-story lock factory at 415-421 Eighth street, New York.

The Concord Axle Co., Fisherville, N. H., has issued a very neat illustrated price list with steel engraved cover.

The Shetucket Co., Greenville, Conn., are setting two 54 inch tubular boilers with the Jarvis Furnace.

Dwight Slate, Hartford, Conn., is manufacturing the "Lay Haight Torpedo Boat," which will be inspected and tested by the French Government.

A new Automatic Gear Cutter manufactured by Dwight Slate, for the E. Horton & Son Co., has lately been put into use.

The Cherokee Brewing Co., St. Louis, Mo., are setting two boilers with the Jarvis Patent Furnace to burn slack coal mixed with wet hops.

Harris Tabor, Superintendent for the Hartford Engineering, Co., is about to leave the service of that company for the purpose of engaging in the manufacture of steam engines at Philadelphia, Pa.

Wells Bros. & Co., Greenfield, Mass., are constructing a new addition to their works 50x26 feet. It is to be a machine room and will be fitted up with a full complement of new tools.

The Omaha Smelting and Refining Co. are setting a boiler with the Jarvis Furnace to burn slack coal and reduce the smoke.

The East Chattanooga Iron Company, a new organization, has begun to build a new blast furnace at Chattanooga, Tenn., to cost $200,000.

The enlargements of the Hopedale, Mass.. Machine Company's shops will necessitate the purchase of a new and powerful engine, and increased boiler capacity.

The Boston *Bulletin* says the new machinery industry to be started at Westfield, Mass., "will supply a long felt want" there.

The Westinghouse Machine Co., 92 and 94 Liberty street, New York, have in operation at their office a high speed Westinghouse engine running at 600 revolutions per minute.

The shareholders of the Kingston, Ont., Car Works, show that of the $100,000 capital stock, $61,000 has been subscribed, and contracts to the amount of $25,000 have been secured.

The subscribers for stock in the proposed car works company at Belleville, Canada, have moved to secure the incorporation of the company. The amount already subscribed in $65,000.

The stockholders of the Athol Machine Company, at Athol, Mass., have voted to build a new foundry building at once; it will be 45x110 feet, and of brick, and will be located near their present shop.

The Crosby Steam Gauge and Valve Company, of Boston, have voted to increase their capital stock from $30,000 to $100,000. It was immediately bought by the present stockholders and paid for in cash.

The Buckeye Engine Co., Salem, Ohio, are building two engines 24" x 48" and 28" x 56", respectively, which are to take the place of the Corliss Centennial engines now in use by Pullman's Palace Car Co., Pullman, Ills.

The Orange County Woolen Mill, Newbury, N.Y., are applying two Rodney Hunt water wheels. They are also putting in a 100 horse power engine and a steel tubular boiler to be set with the Jarvis Furnace.

The factory formerly occupied by the Interchangeable Tool Co., at Milford, Conn., will be hereafter occupied at one end by a company manufacturing horse shoes, and at the other end by a company who will make a business of producing marine torpedoes.

The Torrington Manufacturing Company, Torrington, Conn., have started the manufacture of a 4 foot by 14" engine lathe, and are also about to bring out a 6 foot, 24"x 24" friction planer. They are also busy in their line of special tools and machinery.

Hale, the New York piano manufacturer, has been at Greenfield, Mass., recently looking over the town to see what encouragement might be offered to building in that vicinity. Some of the local capitalists are interested in the matter and it is possible that a manufactory may be erected in the town.

W P. Davis, North Bloomfield, N. Y., has made considerable addition to the capacity of his machine shop by putting in new tools, also has placed a new cupola in his foundry and made a number of improvements in facilities for turning out drill presses and key seating machines. He has just shipped machinery on order to San Francisco, Cal., Denver, Col., Jackson, Miss., and Boston, Mass.

A recent test on the Chicago & Alton Railroad of G. S. Strong's feed water heater on a locomotive drawing seven cars showed the following results: With heater 8,233 pounds of coal were burned and 5.28 pounds of water evaporated per pound of coal. Without heater with same train and same conditions, 10,500 pounds of coal were burned and 4.20 pounds of water evaporated per pound of coal.

The latest addition to the industries of Lawrence, Mass., is the Lawrence Machine Company, owned and run by S. S. & W. O. Webber. These young men are sons of Samuel Webber, one of the first settlers of Lawrence, now engaged in power testing about the country. They have leased the building formerly occupied by Armington & Sims, at the lower end of the canal and are now putting in machinery. Some of their machinery is of English make, but nearly all of it is from American works.—*Boston Bulletin.*

The Shepardstown (W. Va.) Manufacturing Co. has started to erect new shops for building engines, boilers, saw mills, stoves, mill gearing of all kinds, cider mills, clover hullers, etc., and for repairing all kinds of machinery railroad cars and bridges. "The day for a prosperous future for Shepardstown," says the local *Register*, "has dawned we trust and we look forward for happy results in the inauguration of this grand and noble enterprise in our midst." John Halliday will be superintendent of the works.

The Postal Telegraph Co., whose shops cover several acres of ground at Ansonia, Conn., have begun operations. Their process covers the preparation and copper plating of drawn steel wire, using the dynamo machines made by Wallace & Sons, of Ansonia. They commenced operations on 1,000 miles of wire, the weight of the wire being 200 pounds and of the copper deposit 500 pounds to the mile. This wire is to be used between New York and Chicago in carrying out a system of automatic telegraphing which will, according to L. L. Smith the superintendent of the factory and the inventor of the processes by which the wire is prepared and plated, admit of the transmission of about 1,000 words per minute. The wire is taken in at one end of the factory, passed through long plating baths and wound on reels ready for use at the other end.

Machinists' Supplies and Iron.

NEW YORK, June 1, 1882.

Trade in tools continues good for this season and prices show very little change. Some kinds of goods are scarce.

Pig iron sells slowly for early consumption at $25 to $25 50 for No. 1; $23 50 to $24 for No. 2; and $21.50 to $22.50 for Grey Forge. Coltness sells at $26 to $26.50; Gartscherrie at $25.50 to $26; and Eglinton at $22.50 to $23. No. 1 Wrought Scrap is held at $29 from yard. Steel rails are dull at $50 asked and $46 to $49 bid. Old T rails are held at $26.50. Common Pig Lead, 5.5c. to 5.6c.; Ingot Copper, 18¾c.; Banca Tin, 28c.; Straits and Malacca, 21½c. to 21¾c.; Billiton, 21¾c.; Australian, 21¾c; L. & F., 23c. Spelter is quiet at 5¾c.; 8¾c. for Western and 5¼c. for Silesian. Antimony, 11¾c. to 13¾c. as to brand.

WANTED

"Situation and Help" Advertisements, 30 cents a line, each insertion. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—A position as mechanical draughtsman, by a man with shop experience. C. L. Rogers, So. Bethlehem, Pa.

Wanted—Two first class machinists for general work; experienced men on shafting, pulleys, rolls, etc., preferred. Address this paper. Box 9.

Wanted by a young man position as assistant for an experienced draughtsman (mechanical); good references given. Address, Z. box 727, New York.

Wanted—An agent to sell a first-class steam engine; must be competent to advise customers on engineering questions. Address, R., office AMERICAN MACHINIST.

A mechanical and topographical draughtsman, experienced also as civil and mining engineer, is open to engagement. Address, Archimedes, AMERICAN MACHINIST office.

Wanted—An experienced moulder, familiar with pipe work, to operate an Iron Foundry in Newark, N. J. A good chance for the right man. Address Henry W. Bulkley, 149 Broadway, New York.

Wanted—A metal spinner. To the right man, permanent employment and good wages. Address, with references, Empire State Manufacturing Co., Buffalo, New York.

Wanted.—An experienced traveling man in the Injector business. One who thoroughly understands the trade, both practically and as a salesman. Give references and salary expected. Address, A. B., care AMERICAN MACHINIST

Wanted—A man who is a good machinist and accustomed to tinsmith work, to take charge of the power presses and other machinery in a tin can shop. State age, wages wanted and where last employed, to Delaware, AMERICAN MACHINIST office.

An experienced machinist and steam engineer now in charge of the machinery of a rolling mill in an Eastern state, desires a situation of like responsibility in a middle or southern State. Good Boston reference given. Correspondence solicited. Address, box 53, Pembroke, Maine.

Wanted A Party with good mechanical knowledge, of pleasant address and competent for salesman of machinery. With the proper party a liberal arrangement will be made. Address, at office AMERICAN MACHINIST, Burton, stating with what special machinery applicant is most familiar.

Pattern Makers Wanted.—Two or three first-class workers on water works pumping engines. Comfortable shop, well lighted and ventilated, and plenty of work. Call or address, Holly Manufacturing Co., Lockport, N. Y., or C. G. Hildreth, 157 Broadway, N. Y. City.

A man 31 years of age desires a situation in a machine shop as superintendent or foreman. 13 years' experience as apprentice, journeyman, toolmaker, draughtsman and foreman in Illinois, Iowa, Minnesota, Nebraska, Kansas and Missouri. Correspondence invited from parties who mean business. J. E. McConnell, Iowa City, Iowa.

For Sale—A 60 lb. Bradley Cushioned Hammer, entirely new and perfect, at a bargain. Address Lock Box 160, East Hampton, Conn.

For Sale—An I. P. Morris Engine, sixteen (16″) by thirty-six inches (36″) cylinder, with governor. Also a fly wheel fourteen feet (14′) diameter and twenty inches (20″) face. Can be seen at works of Wm. Sellers & Co., Philadelphia.

Machinery for Sale. Putnam Lathe, 27 in. swing, 16 ft. bed, has extension to swing 36 in; Lincoln Lathe, 18 in. swing, 8 ft. bed; Blaisdell Upright Drill No. 2; Belden Planer, 4 ft. 24 x 24. All second-hand in good condition. E S. Fairchild, Lock box 150, Danbury, Conn.

The Second Grand Exhibition Fair
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New England Manufacturers' and Mechanics' Institute
Will be held in THEIR MAMMOTH EXHIBITION BUILDING, (the Largest in the United States),
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Affording the best opportunity for advertising, or of introducing to the public new inventions. Artists, Inventors, Producers, Mechanics and Manufacturers, from every nation, invited to contribute. The product of New England's hand and brain will be well represented. No charge for space. Blank forms for application to exhibit furnished free, upon application to
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FOR STEAM ENGINES,
The Most Perfect Governor Known.
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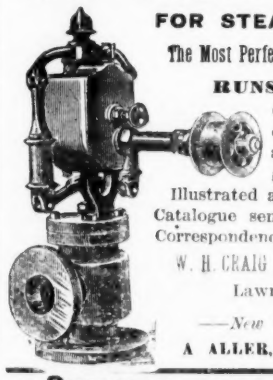

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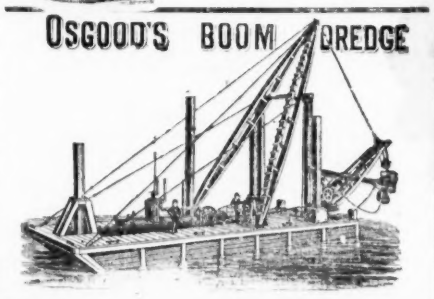

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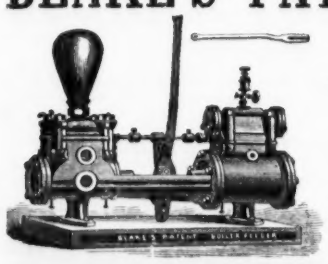

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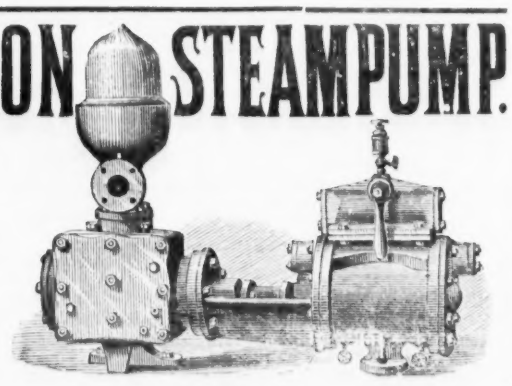

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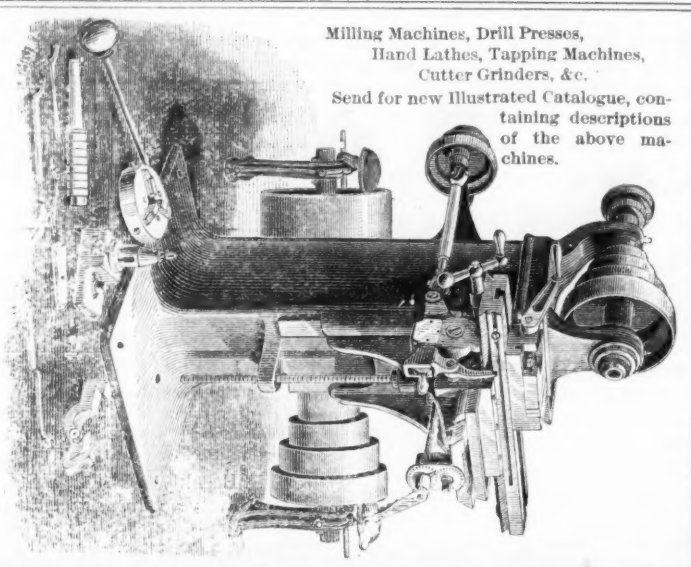

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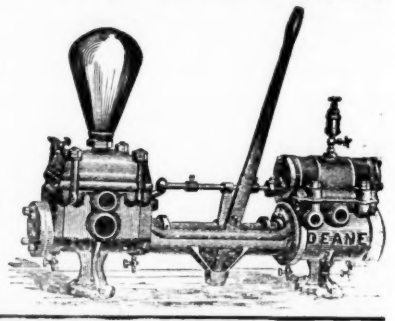

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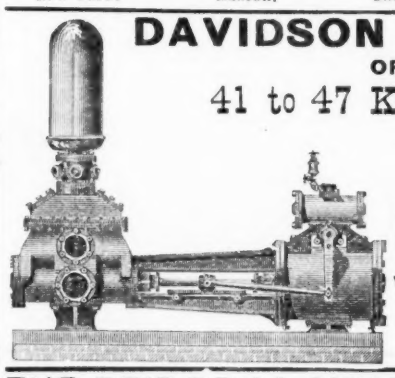

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A practical treatise on the Steam Engine, by Arthur Rigg. Giving details of construction and methods of calculating the the relative proportions of Stationary Engines. 200 diagrams and 96 plates. Price $10.00 in cloth binding.
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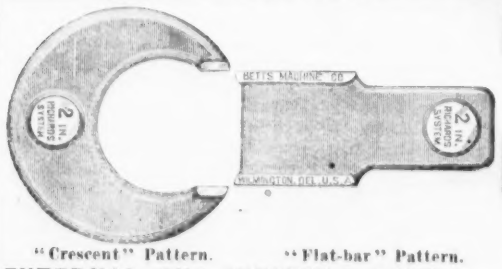

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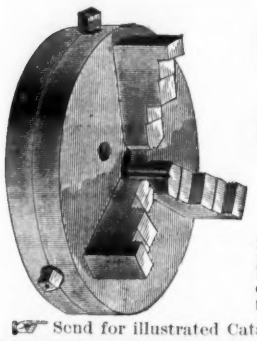

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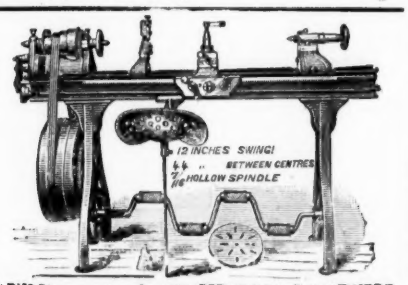

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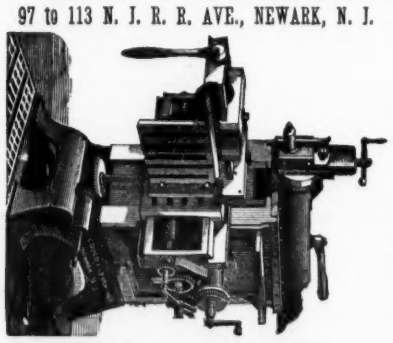

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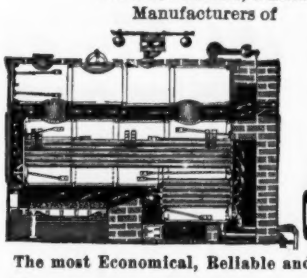

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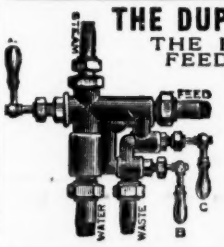

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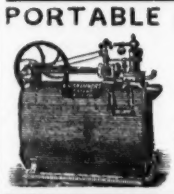

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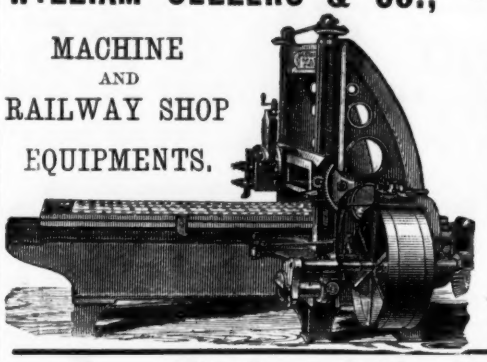

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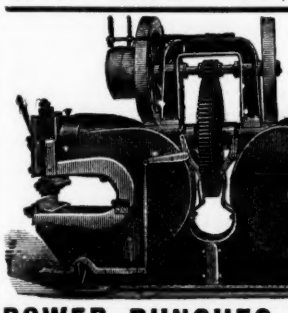

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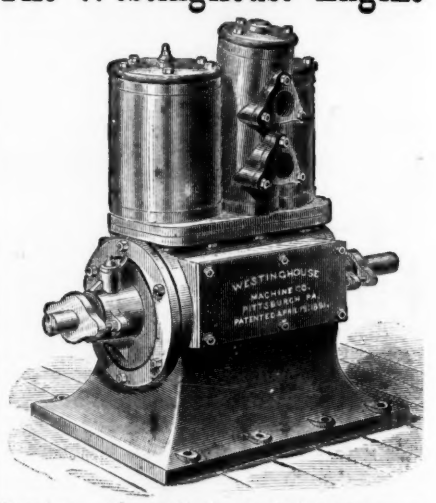

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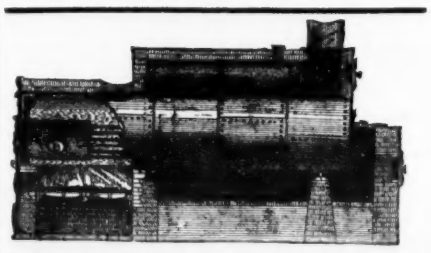

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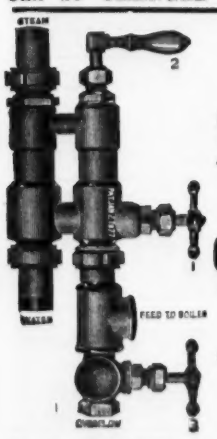

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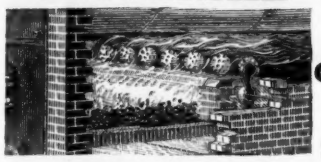

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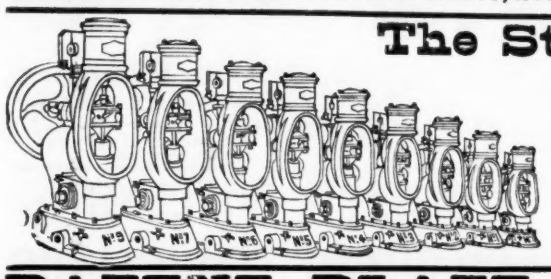

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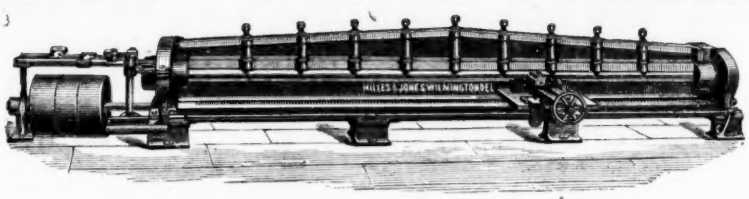

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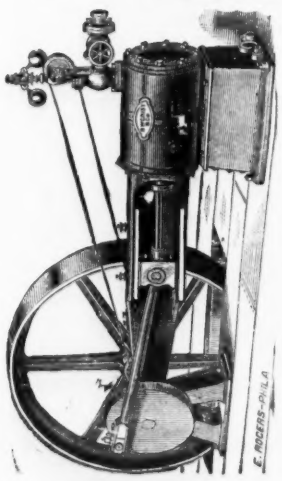

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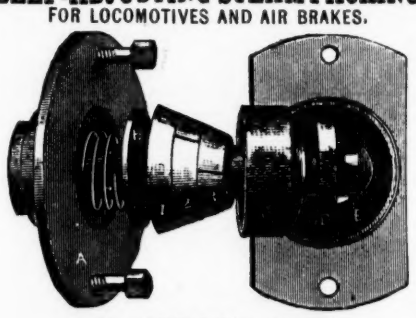

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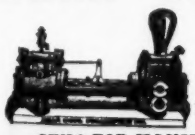

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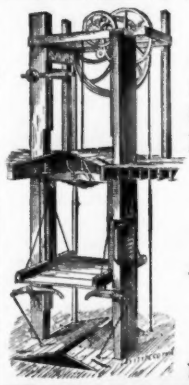

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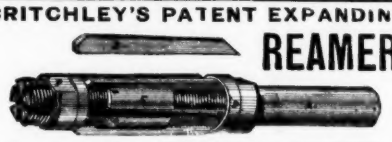

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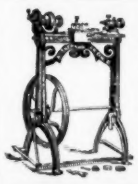

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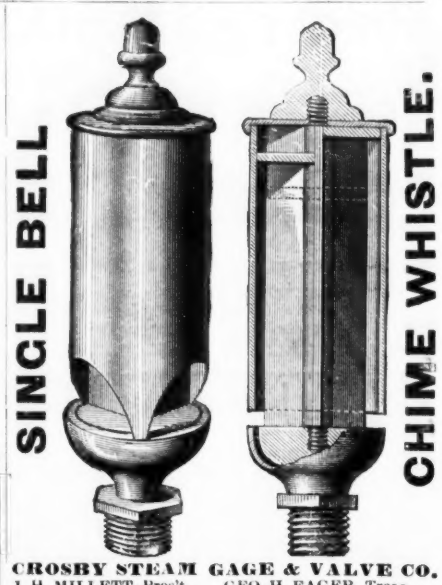

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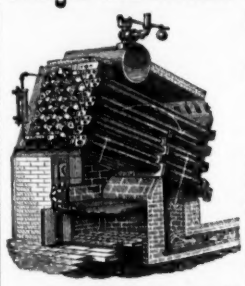

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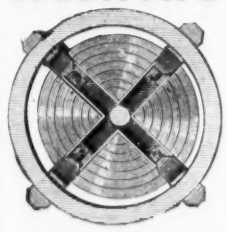

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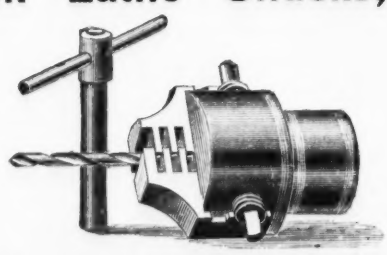

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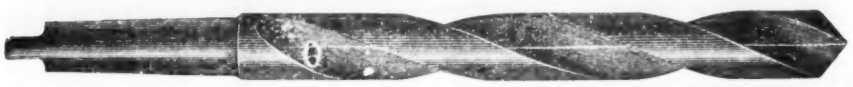

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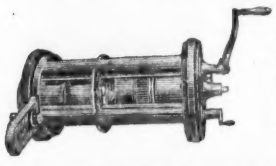

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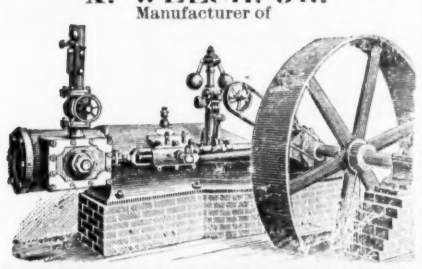

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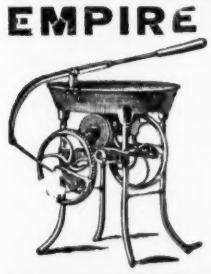

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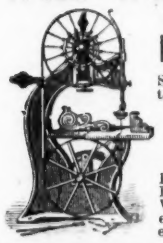

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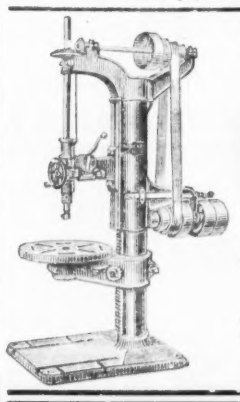

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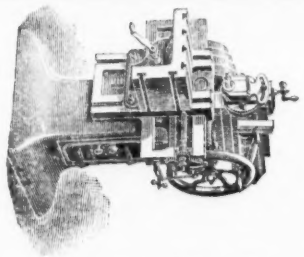

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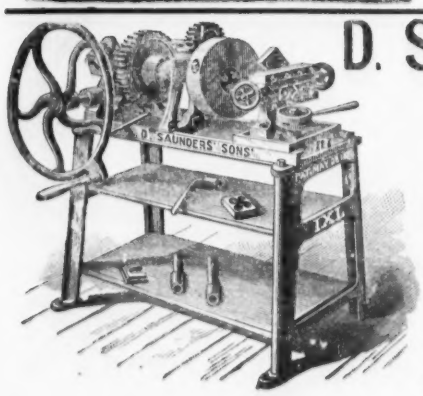

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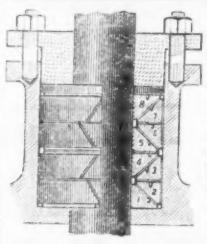

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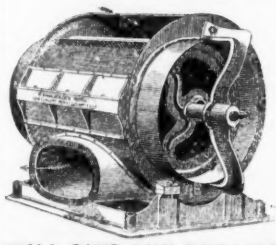

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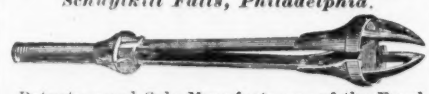

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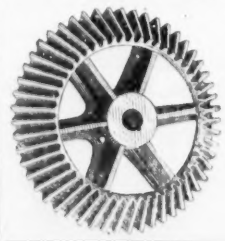

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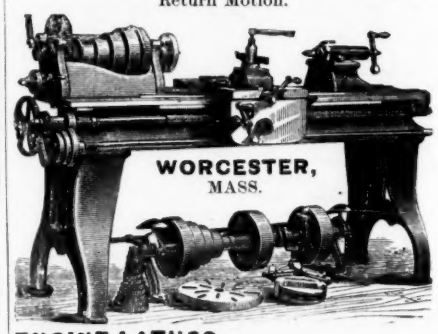

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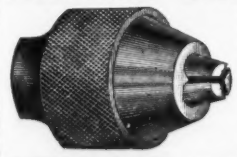

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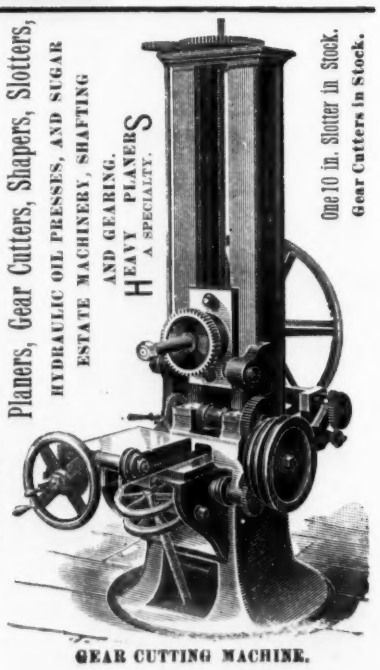

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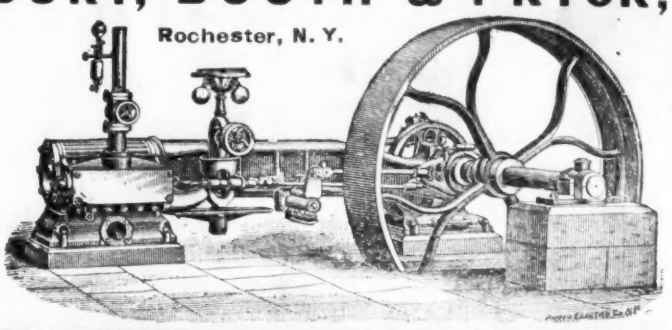

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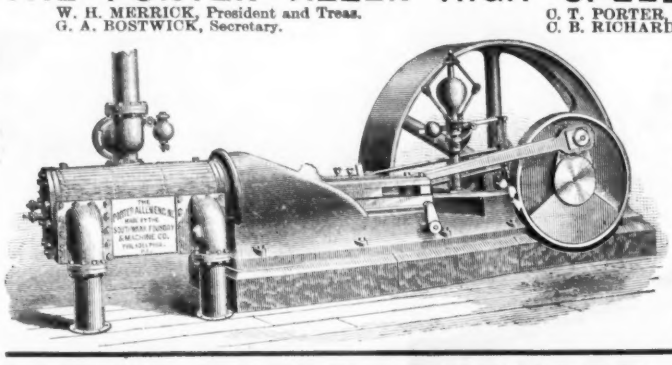

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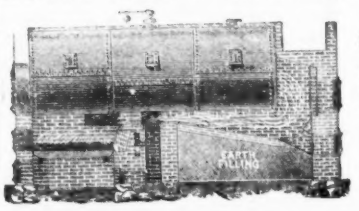

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DRILL PRESSES.

60 inch radial drill, double-geared, self feed, planed and slotted bed-plate with portable table. Best English make. Weight 4 tons.

48 inch radial drill, self-feed, double gearing slotted and planed bed. Betts.

30 inch, back-geared, automatic. Prentice.

25 inch, back-geared, self-feed, Fitchburg.

25 inch, quick return. Blaisdell

19 inch, " " Blaisdell.

18 inch, " " Fitchburg.

18 inch, lever. Reed.

19 inch, " Blaisdell.

PLANERS AND SHAPERS.

30 inch x 30 inch x 8 foot, Fitchburg.

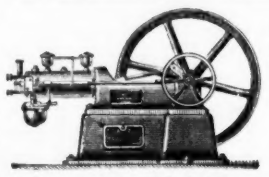
NEW OTTO SILENT GAS ENGINE.

Working without Boiler, Steam, Coal, Ashes or Attendance.

Started Instantly by a Match, it gives full power immediately.

When Stopped, all Expense Ceases.

No explosions; No Fires nor Cinders; No Gauges; No Pumps; No Engineer or other attendant while running.



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Fine Work Generally Solicited.

New and Second-Hand Iron Working MACHINERY.

Two Engine Lathes,	42 in. x 16 ft.	Triple Geared.	Ames. New. June 1.
One Engine Lathe,	28 in. x 16 ft.	Ames. New.	
One " "	28 in. x 17 ft.	" "	
One " "	28 in. x 21 ft.	" "	
One " "	24 in. x 14 ft.	" "	
One " "	24 in. x 12 ft.	" "	
One " "	24 in. x 10 ft.	" "	July 1
Three Engine Lathes,	20 in. x 12 ft.	Ames. New.	
Three " "	20 in. x 10 ft.	" "	
Three " "	20 in. x 8 ft.	" "	
One " "	20 in. x 10 ft.	Jones & Lamson. New.	
One " "	18 in. x 8 ft.	Jones & Lamson. New.	
Two Engine Lathes,	18 in. x 7 ft.	Armsley & Harrington. Good order.	
One Engine Lathe,	16 in. x 6-7-8 ft.	Bridgeport Mch. Tool Works. New.	
Six Engine Lathes,	16 in. x 6 ft.-7ft. x 8 ft.	Ames. New.	
One " "	15 in. x 6 ft.	with Turret. Flathers. New.	
Two Engine Lathes,	14 in. x 6 ft.	Star Tool Co. New	
Three " "	14 in. x 6 ft.	Jones & Lamson. New.	
Six " "	13 in. x 6 ft.	Ames. New.	
Two " "	13 ft. x 5ft.	" "	
Six Hand Lathes	12 in. x 5 ft.	Hendey. New.	
One Crank Planer,	12 in.	Belden. New.	
One Planer	15 in. x 3 ft.	Snow. Good order.	
One "	24 in. x 6 ft.	——	Good order.
Two "	24 in. x 6 ft.	Ames. New.	
One "	28 in. x 6 ft.	Gleason. New.	
One "	30 in. x 8 ft.	Fitchburg. New.	
One "	37 in. x 10 ft.	Second-hand.	Good order.
One 6 in. Stroke Shaper.	Boynton & Plummer.		
Two 9 in. Stroke Shapers.	Hewes & Phillips.		
One 10 in. Stroke Shaper.	Pratt & Whitney.		
One 15 in. Stroke Shaper.	Hendey. New.		
One 10 inch Stroke Shaper.	Gould & Eberhardt. New.		
One 20 in. Stroke Shaper.	G. & E. New.		
One 24 in. Stroke Shaper.	Hendey. New.		
Three Screw Machines.	No. 1.	Pratt & Whitney.	Good order.
One Screw Machine.	Secor.	Wire Feed.	
One Screw Machine.	No. 3.	Plain.	Pratt & Whitney. Good order.
One Screw Machine.	No. 2.	Plain.	Pratt & Whitney. Good order.
Three 4 Spindle Drills.	No. 2.	Pratt & Whitney.	
One 4 " "		Garvin.	Good order.
One 3 " "		"	New.
One 6 " "	No. 1.	"	"
Two 20 in. Upright Drills.	Prentiss. New.		
One 24 in. Upright Drill.	Ames. New.		
One 30 in. " "	Prentiss. New.		
One 38 in. " "	New Haven. New		
Three Sensitive Drills.			
3 No. 2 Profiling Machines.	Pratt & Whitney.		
One Die Sinker.	Pratt & Whitney.		
20 Lincoln Millers and Vises.	Good order.		
One Hand Feed Miller.	No. 1.	Pratt & Whitney.	Good order.
One Hand Feed Miller.	No. 2.	Pratt & Whitney	Good order.
One No. 3 Garvin Hand Miller.	New.		
One 10 lb. Air Hammer.	Hotchkiss.	Good order.	
One 200 lb. Bradley Hammer.	A1.		
One 60 lb. Bradley Hammer.	New.		
Two 400 lbs. Drop Hammers.	Merrill.		
All sizes Bradley Hammers furnished to order promptly			

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DRAUGHTSMAN ADJUSTIBLE T SQUARE

24 IN. BLADE	$ 5.00.
30 IN. "	$ 7.00.
ARC $4.00 EXTRA 40 IN. "	$10.00.
50 IN. "	$15.00.

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New and Second-hand Machinery.

JUNE 1, 1882.

1 Engine Lathe,	14 in. x 6 ft.	Grant & Bogert. New.		
1 " "	22 in. x 10 12 ft.	" "	"	
1 " "	14 in. x 6 ft.	Star Tool Co.	"	
1 " "	16 in. x 6, 7 & 8 ft.	Bridgeport.	"	
1 " "	13 in. x 6 ft.	Ames.		
1 " "	16 in. x 7 ft.	Ames.	"	
1 " "	18 in. x 8 ft.	Lodge & Barker.	"	
1 " "	24 in. x 12 ft.	Fifield.	"	
1 " "	22 in. x 10 ft.	"	"	
1 " "	26 in. x 12 ft.	Lathe & Morse.	"	
1 Plain Engine Lathe,	15 in. x 4 ft.		"	
1 Engine Lathe,	30 in. x 16 ft.	Perkins.	"	
1 " "	16 in. x 6 ft.	"	"	
1 " "	24 in. x 12 ft.	Michel.	"	
1 " "	12 in. x 5 ft.	Prentiss.	"	
1 " "	12 in. x 4 ft.	"	"	
1 Fox "	15 in. x 5 ft.	Pike & Dean.	"	
1 15 in. x 4 ft.	Turret Lathe.	Lodge & Barker.		
1 Planer, 22½ in. x 22½ in. x 5 ft.		A1 order.	"	
"	16 in. x 16 in. x 3 ft.		"	
1 "	24 in. x 24 in. x 5½ ft.		"	
1 Upright Drill, 16 in.	Prentiss. New.			
1 20 in. Upright Drill.	"	"		
1 30 in. "	"	"	"	
1 10 in. Shaper.	Gould. New.			
2 Pratt & Whitney No. 1 Screw Machines.			"	
1 Schlenker Bolt Cutter to take sizes from ¼ to 1¼ inches inclusive. New				

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IRON PLANERS, DRILLING MACHINES, ENGINE LATHES, IRON SHAPERS, ENGINES & BOILERS

A GENERAL LINE OF

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In Store and to Arrive.

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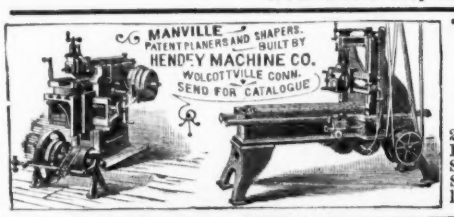

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TORRINGTON, CONN., U. S. A.

Manville Patent Iron Planers and Shapers.

15 in. Shapers, 24 in. Shapers, 3½ ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 8 ft. x 24 in. Planers, Amateurs' Hand Planers, with chuck and centers, Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck, and Common Clock Lathes. Catalogue gives many names of users of our tools.

NEW & SECOND-HAND MACHINERY.

May 31, 1882.

1 Engine Lathe,	14 in. swing x 6 ft. bed.	Ashton Hand. New.	
1 Engine Lathe,	11 in. swing x 5 ft. bed.	New.	
1 " "	11 in. " x 4 ft.	" Prentice. New.	
1 Hand "	12 in. " x 4 ft.	" Young. "	
1 Back Geared Foot Lathe,	9 in. swing x 4 ft. bed, with Slide Rest and 2 Chucks, mounted on wooden bench. Second-hand. Good order.		
3 Babbitt Foot Lathes.	New		
Brigg's Foot Lathes.	Nos 1 and 2.	New.	
Polishing "	Small and Large.	New.	
1 Upright Drill, 2 Spindles.	Garvin.	"	
1 Sensitive Drill		"	
3 Light Drilling Machines.		"	

A full assortment of Lathe Attachments, Countershafts, Chucks, Drills, &c., &c.

FRASSE & COMPANY, 62 Chatham Street, N. Y

Second-Hand & New MACHINERY.

June 1, 1882.

The following New and Improved Machinists Tools are part of what we have for early delivery.

1 30 in. x 30 in. x 8 ft.	Planer.	New.	June.
1 42 in. Swing, 16 ft. bed.	New Engine Lathe.		June
1 42 in. " 20 ft.	" "	"	"
1 36 in. " 12 ft.	" "	"	"
1 36 in. " 18 ft.	" "	"	"
2 30 in. swing, 18 ft. bed.	Engine Lathes.		June.
1 22 in. swing, 13½ ft.	Bed Engine Lathes.		"
5 22 in. x 12 ft.	Engine Lathes.		"
3 19 in. swing, 10 ft.	Bed Engine Lathes.		"
2 11 in. " 5 ft.	" "		"
2 30 in. "	Upright Back Geared Drills.		"
2 9 in. Shapers.	New.	May.	
1 11 in. Shaper, 25 in. Traverse.	May.		

The following on hand:

2 30 in. swing, 18 ft.	Bed Engine Lathes.	New.	
1 26 in. " 16 ft.	" "		New.
2 19 in. " 8 ft.	" "		"
2 18 in. " 8 ft.	" "		"
1 18 in. " 8 ft.	" "	Tilting carriage	
1 18 in. " 11 ft.	" "	"	
1 12 in. " 4 ft.	" "		New.
1 11 in. " 5 ft.	" "		"
1 15 in. " 9 ft.	Hand Lathe.	New.	
3 12 in. " 6 ft.	" "	"	
1 10 in. " 4½ ft.	Bed Hand Lathe.	New.	
1 26 in. x 26 in. x 6 ft.	Planer.	New.	
2 26 in. x 6 ft.	Iron Planers.	2d-hand.	
1 48 in. Swing	Radial Drill.	New.	
2 38 in. Swing	Upright Drills.	B. G. & S. F.	New.
1 30 in. "	" "	" "	"
1 26 in.	Drill.	B.G.&S.F.	New.
1 18 in.	Bench Drill.		
1 2 Spindle	Drill.	New.	
1 4 "	"		
1 2 "	"	Second-Hand.	
1 3 "	"	"	
2 4 "	"	"	
2 Wall Drills, heavy.	Second-hand.	60 and 72 in	
1 9 in.	Shaper.	New.	
1 9 in. "	2d-hand.		
1 Pratt & Whitney	Hand Miller.		
1 Sellers	Milling Machine.	2d-hand.	
1 Face Milling	Machine.	Second-hand.	
1 Pond's Double Milling	Machine.	2d-hand.	
1 No. 2 Screw	Machine.	New. Turret Head.	
1 No. 2 "		Wire Feed. New.	
1 No. 1 "		Brown & Sharpe.	2d-hand
1 Screw Head	Slotter.	Second-hand.	
3 Second-hand	Profiling Machines		
2 4½ in	Hyde's Patent Centering Machines.		New.
1 Emery	Grinder, 2d-hand, for 10 in. Wheels.		
1 Pipe	Cutting Machine.	Second Hand.	2 in.
1 1 in.	Wood & Light Bolt Cutter.	New.	
1 Bolt	Pointing Machine.	Second-hand.	
1 Double Nut	Tapper.	New	Horizontal.
1 Horizontal	Boring Machine,	10 in. Swing.	2d-hand.
1 Betts,	No. 2,	Power Punch	New.
4 Double-Acting	Presses,	No. 3,	nearly new.
4 Single-Acting	Presses,	for power,	"
100 Foot	Presses,	nearly new.	
1 Medium	Power Punching	Press.	Second hand.
2 Small "		" Presses.	"
1 Foot	Punch,	with bench.	New.
1 Lot Pistol	Machinery.	Second-hand.	
3 Grind	Stones and Frames.	New.	
1 Steam	Hammer.	Cylinder 6½x18.	2d-hand.

Lot of Forges 1 Band Saw, 1 Slat Tenoner, 1 Railway Saw Bench, 1 Foot-power Circular Saw, Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in store.

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IRON WORKING MACHINERY.

Complete List of Tools for Quick Delivery Furnished on Application.

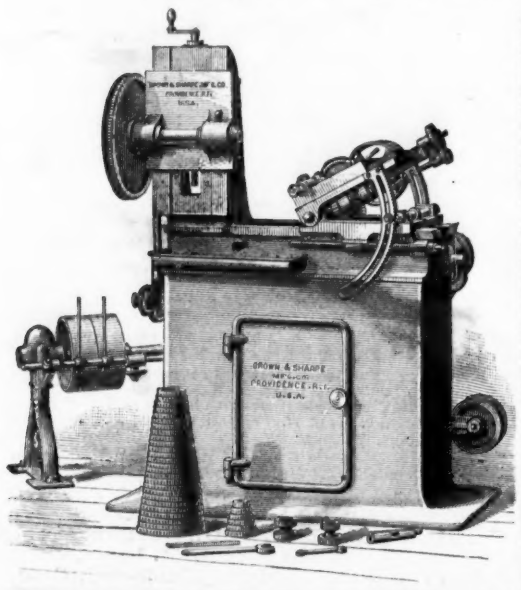
PARTIAL LIST OF LARGE LATHES ON HAND,

40	inch	swing,	16	foot	bed,	Triple	Geared	Gleason	Engine	Lathe.	
40	"	"	12	"	"	"	"	"	"	"	
36	"	"	18	"	"	Double	"	Fitchburg	"	"	
28	"	"	26	"	"	Ames	Shafting	Lathe.			
26	"	"	25	"	"	Powell	Shafting	Lathe.			
26	"	"	20	"	"	"	Engine	"			
24	"	"	12	"	"	Fitchburg	"	"			
21	"	"	14	"	Lathe & Morse	Engine	Lathe.				

SEND FOR ILLUSTRATED CATALOGUE OF MACHINE TOOLS.

BROWN & SHARPE MFG. CO., Providence, R. I.

AUTOMATIC GEAR CUTTING ENGINE.



This machine was designed to meet the requirements of Cotton and Woolen Machinery Manufacturers, or others having large numbers of gears to be made. It is arranged for cutting both bevel and spur gears of sizes not exceeding eighteen inches in diameter, three-inch face, and not coarser than six diametrical pitch (about half-inch circular pitch). It is entirely automatic in all its motions, cutting through for each tooth, and revolving the wheel until all the teeth are cut, thus enabling the operator to attend to other work.

The indexing is done by a worm and worm wheel moved by change gears. The blank being put in place and the cutter head adjusted for length of stroke, the wheel is lowered by a screw having a dial reading to thousandths of inches, until the proper depth of cut is obtained, when the cutter passes through the blank and back by a quick return movement; the wheel is then moved the proper distance for the next tooth, and so on until finished. The cutter head is adjustable at any angle for cutting bevel wheels, the degrees being marked on a graduated arc, no other change being required. There is also provision for moving cutter out of center each way, for cutting bevel wheels. A sufficient number of change gears accompany the Machine for dividing all numbers from 12 to 50, and all even numbers to 100, also all numbers divisible by 3 to 150.

A closet in the base of Machine affords a convenient place for cutters, change gears, arbors and wrenches.

Overhead Works are furnished with each Machine, consisting of adjustable, self-oiling hangers, pulleys, shipper stud, stops, etc Tight and loose pulleys are 10 inches diameter, 3¼-inch face. Countershaft should run 200 revolutions per minute. Weight of Machine complete, prepared for shipment, about 2,000 pounds.

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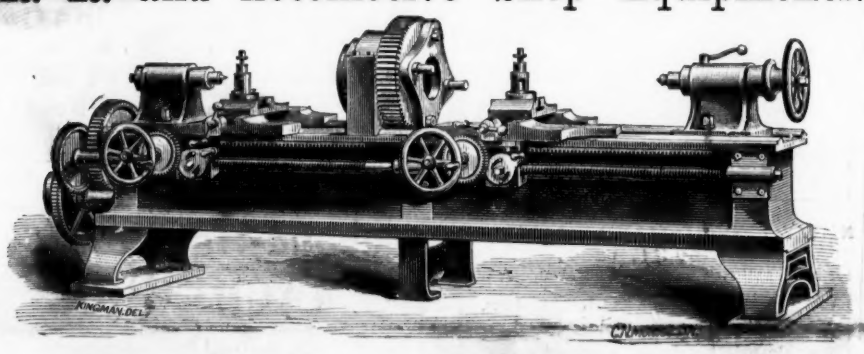

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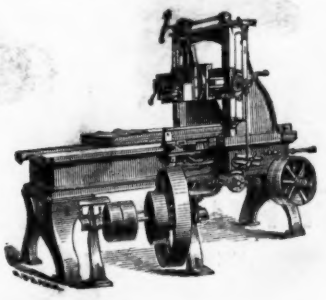

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This Drill can be changed from **Right to Left Hand Drilling** by simply moving the Pawl to right or left.

Price for 10¾" with Socket, to Handle Drills, from ¼" to 29-32" inclusive, and Socket, for Square Shank Drills, $14.00.

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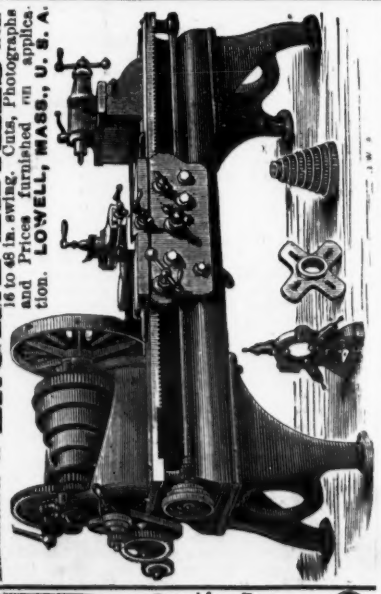

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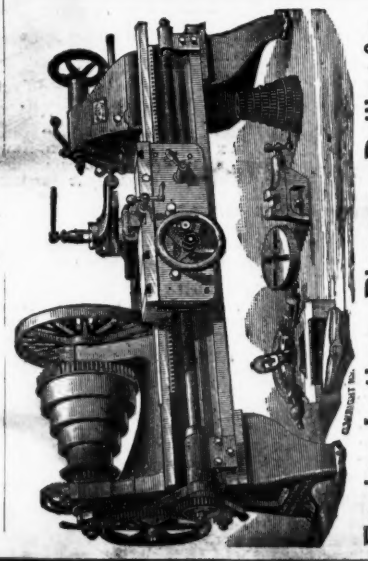

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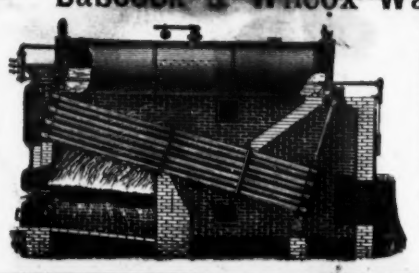

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